AMERICAN MACHINIST

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New Excavator.

We present with this an engraving of an excavator, designed by John K. Howe, secretary and treasurer of the Osgood Dredge Company, Albany, N. Y., and built by that company.

In the design of this machine attention has been paid to securing a more efficient application of the power to the end in view, a more simple construction, in which there should be fewer wearing parts and parts subject to derangement, and what appears to be of especial importance, a capacity to dig and dump at any point in a complete circle. It has also been designed for cheapness in operating, all the necessary movements being made and controlled by one man. These features necessarily involve low cost of construction and extreme simplicity.

By using the dipper handle as a lever, of course increasing its strength to stand the breaking stress, the heavy and expensive crane is got rid of and the power is applied almost entirely in the direction in which it is to work, *i. e.*, parallel to the cutting face of dipper; by fastening the hoisting chain to the upper end of the handle, instead of pulling the dipper away from the bank and requiring special crowding apparatus to overcome this, the hoisting chain now digs and crowds the dipper into the bank at the same time and by the same motion. In hard digging the power may be still further multiplied by the leverage of the dipper handle two, or even three times.

The dipper is kept from sliding out too far or eating too fast into the bank by the backing chain, which regulates the distance at which it works.

The dipper handle is of tee and angle iron, braced, and of triangular section. It is free to slide lengthwise in its saddle, except as controlled by the backing chain. The height of saddle may be changed by adjusting the stay rods.

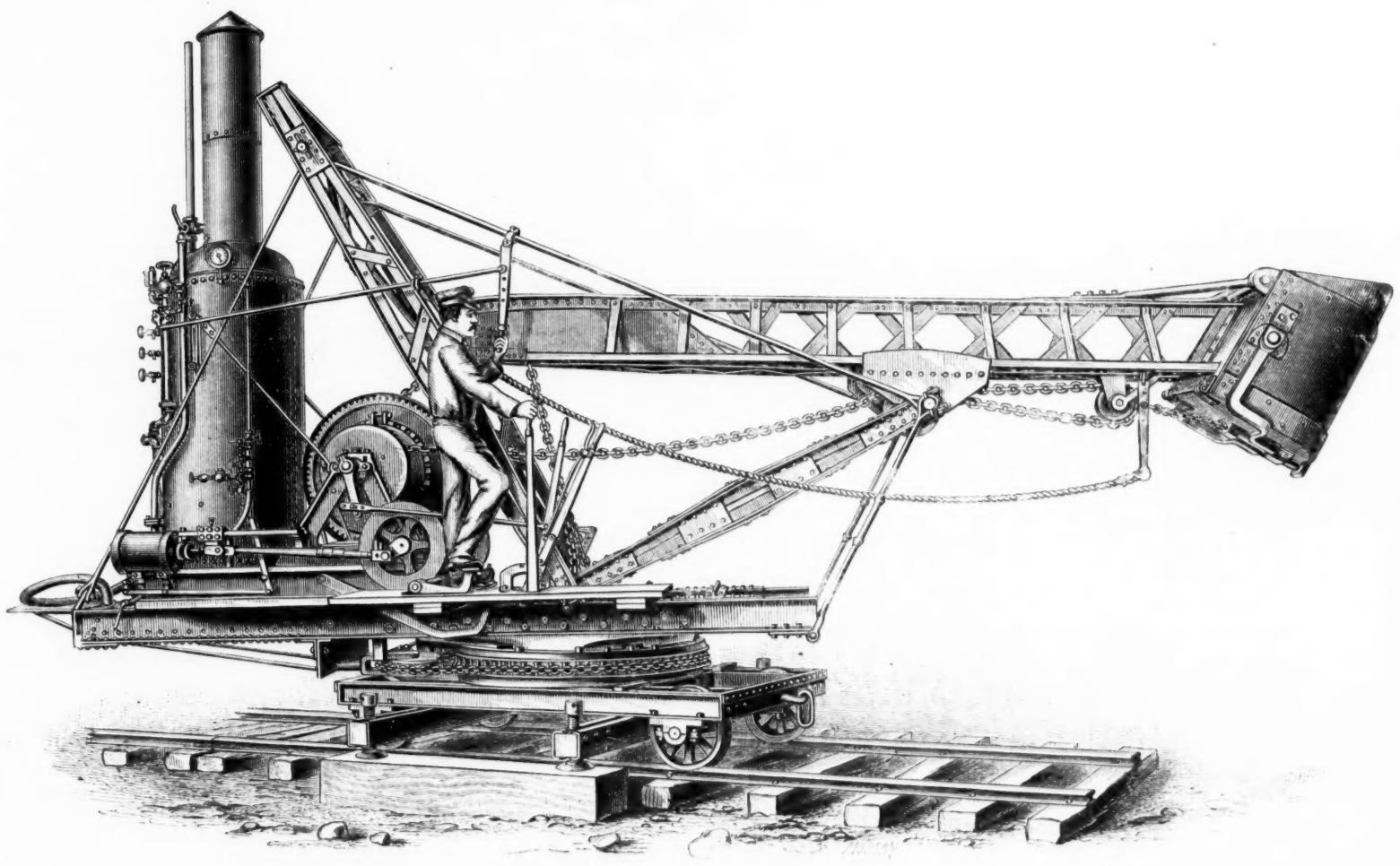
All the machinery, including engine and boiler, is mounted on a frame of channel iron (containing a water tank), which revolves on a ring of coned rollers in the cast iron turn table.

On the crank-shaft are two bevel pinions with band frictions, which drive the upright swinging shaft. This has a chain pinion on its lower end from which an endless chain passes over two tightening sheaves around the base of the turn-table, so that by frictioning one pinion the whole upper part of the machine revolves in either direction, as far as may be desired. When both pinions are released the machine is stationary.

The car is built of I beams and is steadied while at work by four steel jack screws. The machine is moved up to its work by swinging the dipper to the rear and "kicking" the machine forward.

The machine, as here illustrated, has a $\frac{3}{4}$ yard steel dipper, $6\frac{1}{4}$ inch by 8 inch engines with two independent friction drums, and weighs 10 tons. It digs 15 feet from center of track, and dumps 10 feet above track. Its speed in clay is 2 dippers per minute; in gravel, 3. It is handled by a crew of two men only, engineer and fireman. It is built entirely of iron and steel, and is durable.

The Osgood Dredge Company are prepared to build these excavators of any size and capacity.



NEW EXCAVATOR.

The American Order of Steam Engineers has been incorporated in Brooklyn, N. Y. The business and objects of the society, as described in their corporate certificate, are:

"First, to promote a more thorough knowledge in its members of practical and theoretical steam engineering; second to assist members to obtain employment; third, to help the sick, injured and distressed, and bury the dead; fourth, to establish a widows' and orphans' fund; fifth, to help members who shall become incapacitated from following the profession and to obtain employment suited to their affliction.

"The principles of the society shall be, that believing that ability will bring its full value in the market of this country, this society shall at no time take part in strikes nor interfere in any manner between employer and employe; recognizing their identity of interests it shall take no part in any project or enterprise that shall interfere with perfect harmony between them, neither shall it be used for political or religious purposes."

About a hundred well-known engineers in New York and Brooklyn have started the association, and branches will be established in other cities.

The Engineer says:

In any comparison of the British and continental railways it must be clearly kept in view that the British railways are independent bodies, having no interests but that of their shareholders, under no obligations to the public or State, and in a legal view, though not a practical view, owners of a highway which all can use, and they are not compelled to carry goods or passengers.

The above, if true, indicates that in this country we are not yet in so bad a way in regard to railroad monopolies as they are in Britain. We at least believe that railroad corporations are under obligations to the public, and the State, in return for certain rights surrendered to them, and that they are "compelled to carry goods or passengers."

United States Consular Agent McDowall, at Piræus, Greece, gives expression to the following information in a report to the Department of State:

There is no import duty on machinery entering the country, so that this branch of trade is the only one which is not protected; and it is about the only branch which has flourished, and is flourishing, at the present time in the country.

In order to emphasize the stimulating influence of free trade on machinery, and show the folly of our 45 per cent. protective duty, the Consular Agent should have mentioned that the whole machinery industry of Greece, so far as building new work is concerned, is about equal in magnitude to that of Kalamazoo.

The Machinery Trade in England.

The Birmingham correspondent of the London *Ironmonger* of Sept. 25th says:

Excepting on Government account, the machinery trades throughout the country appear to be very indifferently employed, and the experience of Birmingham engineers does not differ from that of their contemporaries. The demand for raw machinery continues very languid both at home and abroad, and foreign competition is making itself keenly felt not only on the Continent, where it is supported by protective tariffs, but in colonial and South American markets, where light machinery and machine-tools of German make are being pressed upon the attention of users at very tempting prices. Hence, doubtless, the great and continued contraction in our exports of machinery, which represents now a loss of 1,134,588*l.* on the eight months expired of this year as compared with the corresponding period last year. The falling-off thus far has been especially marked in steam-engines and motors generally, but the makers of gas and petroleum engines report an increasing demand. In Birmingham it is probable that before long steam will be superseded by compressed air, supplied from mains in the same way as gas and water, but this development will only affect boiler-makers, as ordinary steam-engines can be readily adapted to the requirements of compressed air. For the moment there is very little doing in machinery on account of Birmingham users, who find their plant, as a rule, more than adequate to the needs of business, and merchant orders for machinery are much below the level of the season.

In some parts of the State of New Jersey quite a business is done in mining cedar trees that have been covered by mud for ages. Those that were sound when they fell are found in a perfect state of preservation.

Glaser's Annalen says: "After wood has remained a long time in contact with steam, hot-water or hot-air pipes, the surface becomes carbonized. During the warm season the charcoal absorbs moisture. When again heated the moisture is driven off, leaving a vacuum into which the fresh air current, circulating around the pipes, rapidly penetrates and imparts its oxygen to the charcoal, causing a gradual heating and eventually combustion. The rusting of the pipes contributes also to this result, inasmuch as the rust formed during the hot season may be reduced by the heat of the pipes to a condition in which it will absorb oxygen to the point of red heat. The same article also notices that a building was set on fire by pitch distilled out of a pine plank placed nearly 3 inches above a steam pipe, which dropped on the pipe and took fire."

The United States is the largest copper producing center, her annual output being 74,000 tons. Chili comes next with a total of 38,000 tons, while Spain and Portugal have a combined annual production of 45,000 tons. Germany puts out 12,000, Australia, 11,000, and Japan, which is the lowest on the list, only 2,000 tons annually.

W. W. Eaton says in the course of an article in the *Northwestern Lumberman*:

"Sixty years ago the furniture manufacturers from Boston to Eastport sawed all their veneers (by hand.) A plank or block of plain or branch mahogany, or bird's eye maple, was firmly fixed in the jaws of the bench-screw, and while thus held a single veneer was sawed from the smooth, level side by means of a thin saw, about five feet long, held rigidly in an oblong frame. Two men—more generally a first-class workman and an apprentice—kept this saw in motion without resting until they sawed a veneer large enough to cover the front of at least one bureau drawer. The veneer was a large sixteenth of an inch in thickness. The saw kerf reduced to dust fully as much more of a beautiful burl, branch or crotch. This loss of such a large proportion of fine wood in preparing it for use occupied the meditations of many a thoughtful man to devise some means by which such precious blocks of rare wood could be sliced into thin sheets without loss. Very thin circular saws were run at a low rate of speed, that they might not heat and warp; but yet the kerf continued to be about equal to the veneer—a loss of 50 per cent.

"At last some genius prepared strips of very fine, thin saw-plate and ground the teeth to the shape and thinness of a surgeon's lance. The opposite ends of these steel plates were screwed to the base of a large steel or iron cone—standing out similar to the spokes of a wheel. The center of this cone was perforated and received a large iron axle with which it turned. Thus arranged, the bottom of the cone, which held the extended, spoke-like saw-plates, became the working side of the saw, and, of course, came next to the block designed to be cut into veneers.

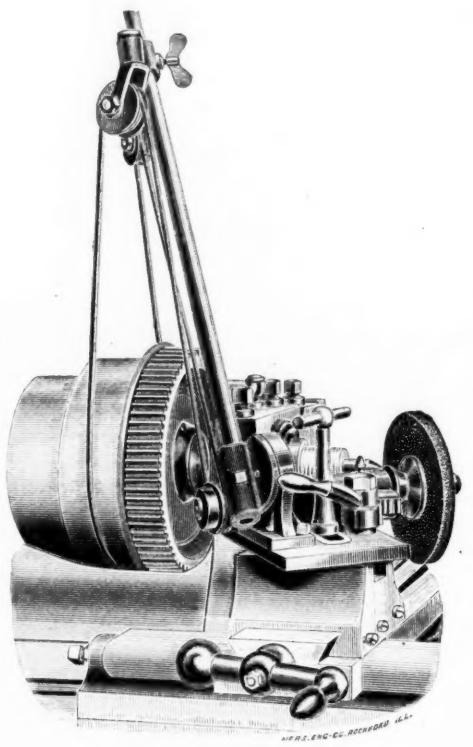
I saw one of these in successful operation more than 40 years ago in Old Salem, Mass. It was a complete success. The fine lance points scattered a little dust fine as snuff; but the waste of material was scarcely perceptible. As the thin veneer was gradually removed the smooth polished cone slid it off the block, so that no part of the saw-plates was pressed against the block so as to cause over-heating or expansion. Large sheets of veneering, but little thicker than wall paper, were thus delivered in the very best possible condition to be glued to any well-seasoned wooden surface, and so smooth as to require only the scraper and the sand paper to prepare it for oil, varnish or polish."

Center Grinder.

The grinder is quickly attached to the tool block of the lathe by a bolt with a convenient T handled nut. It may be set at any angle desired. The emery wheel spindle is $\frac{3}{4}$" diameter and runs in babbitt metal boxes. It is carried on a gibbed slide, which is moved parallel with the face of the center to be ground by a rack and pinion, and the handle shown in front.

Power is taken from the cone of the lathe by a single belt running over idler pulleys. These idlers are self-aligning, being mounted in hangers having a swivel bearing in line with the belt to the spindle pulley. The head carrying the idlers can be fastened at any point along the supporting bar. The belt can thus be instantly adjusted to the lathe by pushing the idler pulleys up on the rod until the belt is tight. The bar is connected to the bed by an elbow joint allowing it to be moved backwards or forwards, as may be required to bring the idlers over the lathe pulley. In the case of large lathe, where it would be inconvenient to remove the face plate, the belt may be run on the face plate instead of the cone, by placing the emery wheel on the left of the machine, the spindle being made reversible for the purpose.

The manufacturer of this machine is A. W. Woodward, Rockford, Ill.

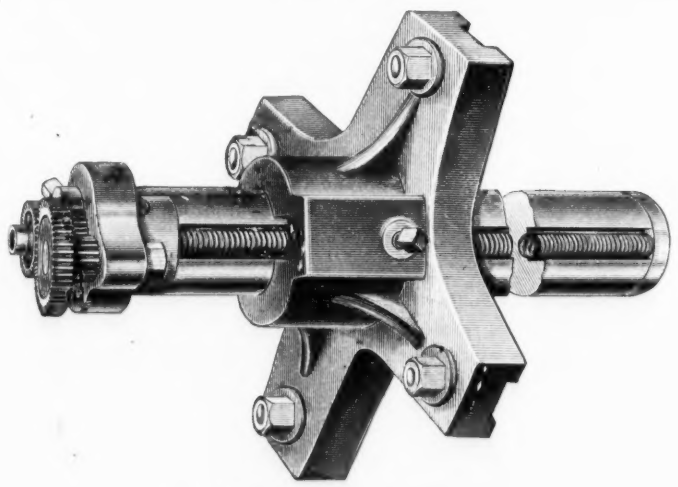


Center Grinder.

Boring Bar for Lathe.

This bar is made of any required size. It has hardened centers, and is carefully fitted up with bronze thrust bearing, by which all lateral motion is avoided. The feed is automatic, by means of cut gears and steel feed screw. Suitable cutter heads, with adjustable tool holders, are furnished.

The manufacturers are Pedrick & Ayer, Philadelphia, Pa.



Boring Bar for Lathe.

The *American Manufacturer* says: "We have learned during the past week that one of our prominent concerns of Pittsburgh, which has used a large amount of steel, has decided that for some of its product it must return to the use of puddled iron, and they propose erecting in the near future an additional number of puddling furnaces. This by no means indicates that there has been any material check in the movement to substitute steel for iron. It simply indicates what was evident from the first, that experiment was necessary, and an experiment extending over some space of time, to indicate the uses for which steel was especially adapted, and the purposes for which it would be wise to continue to use iron. We understand that the railroad companies are not entirely pleased with the success that has been attained in using steel for axles, and a similar statement is true to some extent regarding structural shapes. Possibly it may be found, however, that even for these purposes it is not necessary to return to puddled iron, that where Bessemer has been used without the most gratifying success, open-hearth can be used, and vice versa."

The thing which is in the direction of current thought is sure to receive the most attention. For the past fifteen years there has been a contest between iron-clads and rifled cannon. Iron-clads have been built that would withstand the shots from any gun built; then the gun has been improved, until its projectile would pierce the armor. Just now it is hazardous to predict which is ahead. But all the while the contest is going on, unnoticed, in everything else. The engine lathe or planer of twenty-five years ago was good in its time; but the user always wanted to remove metal faster, and leave better surfaces than the tool was capable of. The builder, on his part, was always trying to beat the possibilities of the cutting tool to remove metal. It is a contest that will never be done with.

The old-time steam engine that stood up under a pressure of seven pounds, and fifteen or twenty revolutions per minute, was in a bad way when users began a crusade against it with high steam pressure and high speed. Ever since then there has been a contest, on one hand to beat high speed and pressure, and on the other to beat the engine.

All these contests mean progress, and in the nature of things must continue. There is no more contest between guns and armor than between anything else.

When a piece of work to be scraper finished comes from the planer, it should be tested by the straight-edge, the straight-edge being laid lengthwise and sidewise on the work and placed in different spots. To reduce protuberances and to remove the planer marks, a float file, followed by a finish file, should be used, the workman being careful as the true surface appears not to bear too heavily on the untouched surfaces, as they present less resistance than the dressed or filed surfaces. A wash of spirits of turpentine is then passed over the work, by a rag or brush, and the surface plate rubbed over the washed surface. Wherever the plate touches the turpentine is rubbed off and a bright spot appears. This spot—and there may be a hundred of them—is to be scraped, then another wash, another surface plate test, and the scraping continued. A narrow line or a small dot of bearing brightness must be proportionately lighter treated with the scraper than a sensible expanse of bearing. In this and similar little things judgment is required.

The practice of using a smear of red lead to show bearing between surface plate or straight-edge and the work is not a good one. In time it fills all the fine depressions of the metal and makes a uniform smooch. Turpentine is cleanly and leaves but a thin, semi-transparent film.—*Jesse H. Lord in the Manufacturers' Gazette.*

A correspondent writes us to the effect that he does not believe in the theory of low water causing boiler explosions. He says:

"I once saw a marine boiler with fire-box, crown sheet and return tubes that was dry or nearly so. There was a good fire, and the boiler was pumped full of water, without injurious effect.

"I ran a hundred horse-power boiler two hours with water below the fourth row of tubes, and pumped water back to proper level without stopping.

"Three weeks ago the boiler I have in charge was dry with a good fire. I pumped it full without pulling fire; it did not blow up, but every tube started leaking. Such practice does not do a boiler any good, but it will not blow them up unless repeated."

No one will assert that a boiler may certainly be blown up by the practice our correspondent delineates, but if there is any one besides the engineer exposed to such carelessness, it is criminally negligent. Boiler sheets heated red hot are not only weak at the time, but when suddenly cooled are subject to fracture. Pumping up a boiler when the sheets are red hot is a fool-hardy practice.

It sometimes becomes necessary to destroy property to save time. An example of this was in the instance of the building of a bridge on the New York, Susquehanna and Western Railroad, recently. A temporary bridge was to be built in the shortest possible time. The engineers calculated that this bridge would be finished at a specified time. According to orders the track was full of

freight ready to pass over the bridge at the hour specified. Just a few minutes before the time was up everything was ready, except that the pile driver was to be removed. If done in the ordinary way the time would be exceeded, but the engineers were equal to the occasion. They cut down the supports and let the pile driver, engine and boiler, into the river.

C. L. Redfield, consulting engineer of Minneapolis, writes us: "Minneapolis is truly a great and growing city, and the exposition is its greatest success. It closed up Saturday night with a blaze of glory and a pair of twins born in the building. This scores another victory over the rival down stream, and is charged as being a scheme to beat it in population. It is currently reported around that bids are in for next year's twins."

Practical Drawing.

By J. G. A. Meyer.

FIRST PAPER.

In studying the solutions of some of the problems relating to modern locomotive construction, or, in fact, to steam engineering generally, it is absolutely necessary to have some knowledge of practical drawing. To aid the readers of the American Machinist in gaining a knowledge of this subject is the purpose of the following papers.

PRACTICAL DRAWING.

1. Drawing in its widest and fullest acceptation may be defined as the art of representing on a flat surface the boundaries of an object by the means of the combination of lines, thus producing a correct resemblance of the same.

2. Drawing, or the delineation of objects, may then be called a written language, employed to convey or communicate ideas of form. Its usefulness is at once apparent, for it enables any person to describe the form or shape of objects by the means of a few well-defined marks, giving a description which would require a great many words if drawing should be dispensed with.

3. The lines thus drawn to represent the boundaries of an object limit its apparent dimensions, and such a combination of lines is named the outline of an object. When an outline of an object is represented on a surface, it is simply called a drawing.

4. We may then, simply with the aid of a pencil, and without the aid of any other instrument, draw the outlines of an object as it would appear to the eye, and thus convey our idea of shape or form to other persons. This is what we call free-hand drawing. But as soon as we classify the lines which compose the outline of an object, and construct each line according to some particular rule, compare these lines with some other line taken as a standard and indicate the position of lines in space according to some law, we follow a science, that is, a knowledge of laws, principles, and relations; or truths attained by a course of methodical study.

5. We can apply these same laws, and correctly too, in such a manner that when the drawing is completed it will be of no use to the mechanic.

Let us see how this is possible, and what the result will be. To make this comprehensive let us suppose that we are looking at the front of a very handsome building, from some particular position—in fact, such a position from which the outline of the building will have the most pleasing effect to the eye, and while in this position we make a drawing of it, representing it exactly as it appears to the eye, and in strict accordance with the rules and principles we have alluded to, and then shade and color the drawing correctly; the result of this will be a correct perspective drawing. Now, if this drawing is made by a talented and experienced person, we have a work of art, and the one who made it is an artist, whose work will call for the admiration of those who look at it; and deservedly so, for it requires a great deal of study and practice to become an artist. The study of perspective drawing is an excellent study, and we shall not close this treatise without treating upon the subject.

6. But still perspective drawing is of little use to the workman. To explain this, let us refer again to the picture of the building, which, as we have already seen, represents its front. Now, one reason why this does not meet the demands of the mechanic is, because it only shows what the front looks like. Of course we can take another position in the rear of the building, and make a correct perspective drawing of its rear side; and in the same manner we can represent all its sides; also the interior of the building. All this is absolutely necessary, to give the needed information to the mechanic; but still perspective drawing is not satisfactory to him.

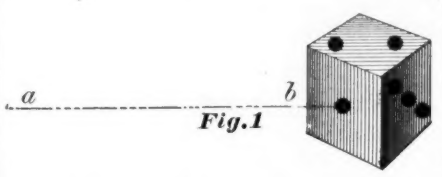


Fig. 1

7. Although we have not yet shown what kind of drawing to give to the practical man, we have pointed out one fact, and that is, more than one view of an object is necessary to show its complete form.

8. Let us examine perspective drawing more closely, and find the reason why it is not suitable for a working drawing.

For the purpose of giving a clear explanation we will refer to Fig. 1, which is a correct perspective drawing of a die. We have chosen this simple object because it seemed to us that very nearly every one, if not all of our readers, are familiar with its form. Fig. 1 represents the die exactly as it would appear to the eye, when it is placed a certain distance before us and a given distance below the point of vision. If we now examine the die itself we find it has six sides, and all exactly the same size, but in our drawing we see three sides, and all of a different size. Again, applying a square to the die itself, we find that the edges are square with each other, yet in our drawing no two lines are square with each other. Once more if we measure the distance between the edges of the die, we find them all an equal distance apart and parallel to each other, but in our drawing the distances between the lines which represent the edges of the die are not equal, and only three lines out of eight are parallel. Now we can perceive that, no matter how correct our perspective drawing may be, it does not show the true form of an object, although it represents the correct appearance to the eye. Still, as we have already seen, it is not the fault of the construction, or the application of wrong principles and laws, that the true form is not shown.

9. The simple reason for our failure of furnishing a suitable drawing for the workman is that we have commenced our drawing with the intention of producing a good picture, and for that reason have chosen such a position from which to view the object, that a pleasing representation of it would be the result. But since we are at perfect liberty to choose any position from which to view the object, we can, and therefore must, choose such a position that its true form will be seen.*

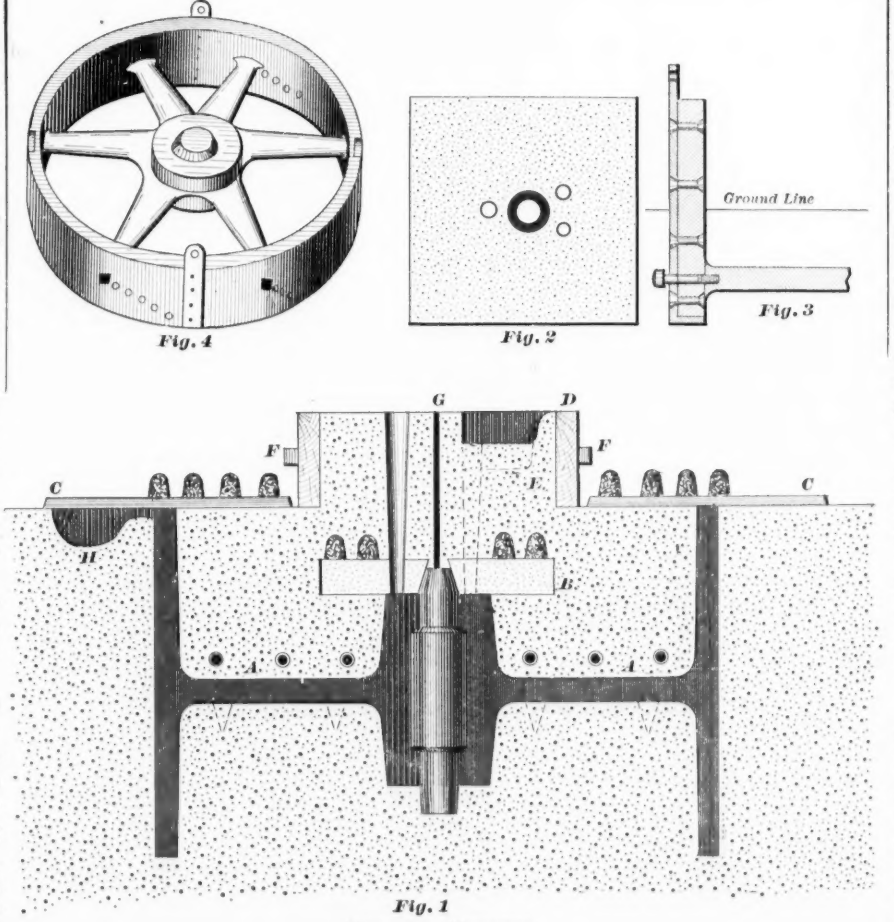


Fig. 4 Fig. 2 Fig. 3

Fig. 1

Moulding Pulleys.

* The position of the picture plane is of equal importance, but since the student is not supposed to know anything about it at present, we have not mentioned it, but will explain it when necessary.

"The *Gazette* is on top, and if the signs of the times are any indication of what the future will be, it's going to stay there." So says the *American Furniture Gazette*, of Chicago; and upon looking over its 98 pages of ads. and 14 pages of reading matter, printed in nearly all the colors of the rainbow, it does look as though it had become pretty well elevated.

A new trade paper in a new field is the *Restaurateur*, "a journal for restaurants, chop houses, lunch rooms, cafés and hotels." The new venture is a monthly published by J. W. Pratt & Son, 75 Fulton street, New York, and the first number, dated October, 1886, is unexceptionable in typographical appearance and editorial make-up. It has fine illustrations of the interior of restaurants. Some of the contents are spicy, some sugary, some oily, a small portion peppery (where it exposes bogus articles of food), but none vinegary. The *Restaurateur* will be issued the first of each month at one dollar a year.

The industry of incorporating new stock companies is just as flourishing as ever. Neither good times nor dull times seem to have much effect in changing this industry. The amount of manufacturing and mining stock for sale is immense.

Moulding Pulleys.

By Robert E. Masters.

The drawing Fig. 1 shows the moulding of a pulley 9′ diameter, 18″ face, rim 2¼″ thick, from a ring pattern with loose arms and lifting plate. This pulley was moulded in a foundry that had lately suffered from a fire in which a number of flasks had burned up and there was no flask on hand to make it in. It was an awkward job well done.

The ring pattern was leveled up in the floor, rammed and drawn up, the arms bedded in, and the lifting plate shown by the dotted lines and dots *A A* fitted in.

A large flat, dry, sand core, shown in section at *B*, and in plan Fig. 2 was struck up and the core print to be used on top of the hub was bedded in the core, as shown by the large hole in the center. The two holes to the right of the core print were for the pouring gates and the one at the left for the riser. This large core was well strengthened by good heavy rods and made so that extra weight could be placed over the hub to help resist the strain at that point. A parting was made on a level with the top of the hub and the core put on over the top print and weighted down with pigs laid crosswise on it. The rest of the pulley was rammed up on a level with the floor.

Broad planks were then laid on the floor lengthwise from the pulley with one edge near the outside of the rim. Other planks were laid across these for standing room when drawing the pulley and to keep from crushing in the edge. Before lifting out the core from over the arms air-slacked lime was shaken down on the inside of the mould and the joint marked with a "lifter" at the parting of the arms to serve as a guide in putting the core back on again. Before setting the core back ropes were attached to the chains that supported it in the crane to steady it and to pull one way or the other to guide it into its place.

The long broad core plates *C C* were then placed across the mould a few inches apart all the way around. The runner box *D* was built up with a dry sand core *E* at the bottom of the basin and the whole thing weighted down. *F F* are clamps to strengthen the runner box, *G* is the vent from the center core. The rim of this pulley was poured open and "the word" was given when the rim was full to stop pouring, so as not to run it over. *H* is an overflow basin.

In moulding the pulley the rim was made 9″ deep below the center of the arms and 10″ above the center. This left an inch ring to be cut off the top for whatever dirt might gather.

Casting pulleys in green sand with the rim open is practiced in a very few shops and will be a new feature to many. Although whether made with a lifting plate or with cores for the arms the outside of the rim is usually made so that it can be cheeked off and the inside of the pulley dressed up around the cores or joint.

One well known firm that make a great many large pulleys cast all of them with the rim open. Instead of having a ring 6″ or 8″ wide and drawing it up, which is usually the case, they have two band patterns of each diameter, heavy and light, 36″ deep, and two sets of arms (heavy and light) to suit. Figs. 3 and 4 is a section and plan view of the patterns.

In the rim are rows of ½″ holes 1″ apart on a line from center to center, commencing 2″ from the bottom and running diagonally across the face of the rim as far as the center as seen in Fig. 4. The arms are of cast-iron and have a hole in the end for set screws to hold them to their place until the lower half of the core is rammed up. Pulleys can be made on this plan in much shorter time than drawing up.

For instance, to make a pulley 6′ diameter 12″ face set the ring on the floor, fasten the arms in with set screws 6″ from the bottom, ram up under the arms, and make the parting for the plate. The set screws can then be taken out and the outside rammed up. The upper half of the rim is left a little deeper to dress up clean in the machine shop; and wrought iron straps are riveted in flush with the rim to draw it by.

Cable Pulleys.

By F. W. Barrows.

Supposing we wish to make a wheel or sheave with a spiral groove on its rim for a rope or wire cable. Such a wheel is, I think, sometimes used with hydraulic elevators to regulate the flow of water by controlling the valve opening.

The pattern may be made in the same way as the pattern for the four-grooved sheave illustrated in my last paper. The core box is to be so made that it forms the spiral groove. It will be necessary to make but one part of the whole circle for the core-box, the length of this part being governed by the size of the wheel.

Let us divide this core into six parts and let the groove make three turns, then the pattern would be of the same thickness as an ordinary sheave having four grooves on its circumference, and if we have a pattern for a four groove sheave, of the right diameter, we can use it for this wheel, as the only difference will be in the core-box. Though the casting, in this case, will have some iron in it that is unnecessary, and which might be avoided by a special pattern, let us make one from the pattern which we already have, as this will require only a core-box. Make the core-box in this way: Get out the bottom of a length equal to one-sixth of the greatest circumference of wheel, and of the same radius, and the width must be three grooves, plus one groove, on each side, plus the thickness of the two sides of the box. The pitch of spiral will be the distance between the centers of two adjacent grooves.

If we make two lines on the surface of the piece for bottom of core-box, these lines to be located at equal distances from the two sides of bottom piece and distant from each other one-sixth of the pitch, and then draw another line from one end of one of these lines to the opposite end of the other, we shall have a line that will represent the pitch of groove, and all other lines necessary in locating the grooves will be parallel with this pitch and may be laid off from this first pitch line.

The grooves may now be worked out. Get out the two sides of box, fit them to the bottom, cut them to the right width and of the same length as bottom of box. After the grooves are worked out, the ends may be fastened on. Make them as wide as the bottom. Now we must fix the sides of box so as to allow for the change in position of the grooves as they pass around wheel. Let us begin where the groove comes nearest to side of rim. Set off from the outside groove the thickness of outside flange, and draw a line through this point parallel with the side of bottom of box. When this line reaches the opposite end of core-box, it will be distant from the groove the thickness of outside flange, plus one-sixth of the pitch. Transfer this new distance back to the first end of box and draw another line through this new point, parallel with first line. This line will be distant from the first one-sixth of the pitch. Thus we will go on until six lines have been located and drawing all parallel with the side of core-box, not with the grooves

Then we will draw six more on the opposite side of grooves, and distant from the first six in regular order, just the thickness of core print on pattern, as this will be just the thickness of prints on cores. It is evident that if we set off the thickness of this print from each of the first six lines in succession, we shall get the correct positions for the last six. The first six should be numbered, then number each one of the last six to correspond with the number of the line that it is spaced from.

Now, by fixing the sides to each pair of lines in succession by either pins or screws, we can make six cores that will, if we have been kindly remembered by the core-maker and moulder, form a continuous spiral groove, making exactly three turns around the circumference of wheel, beginning and ending with an abrupt, square shoulder, and leaving a good deal of iron outside of the groove that is of no use.

Let me first show how to get rid of the square end of groove. Suppose we let the groove make $3\frac{1}{6}$ turns, and let a portion of each end of groove—equal to $\frac{1}{12}$ of circumference of wheel—be tapered off to suit the job.

We shall now have a straight groove, or rather three parallel grooves, reaching $\frac{5}{6}$ of the distance around wheel. For the remaining $\frac{1}{6}$ there will be four grooves, the two outside ones being tapered off from the center of this part of circumference towards the outer ends.

To form these tapered ends of groove, we may make a special core box for this segment of core. If there are many castings to make, or where only one or two castings are wanted, we can make these ends in the same box cutting only one of them into the bottom of box, beginning with the full depth of groove at the end of core-box and running out towards the center. Then make a piece to fill up this end when not wanted. A little care on the part of core-maker and moulder will make the casting come out all right. Make two cores in the full box, and four with the tapered end stopped off. In setting the cores, put the ends of the two made first, having four grooves, together.

Now, to get rid of the extra iron in rim of wheel, we shall have to make a special pattern, cutting off the rim to the required form, and making provision for leaving the ends of groove in any required form—say we wish to turn the end of cable down through a hole and fasten on the inside of rim.

You will see that the core-box that is to make the greatest part of the core for this pattern may have the sides fixed at a regular distance from and parallel with the grooves, as the cores will all be alike except at the ends of groove. If the groove is to make exactly two, three or four turns, we will simply have to make a hole in the core-box at the outer end of one of the outside grooves, of such depth as will cut through the rim. One hole will do for both ends of groove. If the groove is to make $3\frac{1}{6}$ turns, we will cut out one side of box for one-twelfth of circumference of wheel—the amount cut away to be regulated by the size of the groove and shape of pattern. Then we must work out the groove in this portion of box, ending with a hole down into the bottom of box at the center, or finishing the end of groove in any other manner thought advisable. We will want a piece to stop off this extra groove; for the core-box, if originally intended to make one-sixth of the full core for a three-turn wheel, would now have four grooves for one-half its length.

For making the last description of wheel we should make two cores from the full box, and four cores with extra groove stopped off.

The two full cores, by placing the ends having four grooves together, will complete the three and one-sixth turns to be made by the groove.

It will be necessary for the moulder to exercise a little care in setting the cores, especially in the first wheel, which we made off the regular four-groove sheave pattern, as these cores must all be placed each in its special place, except the two cores where the groove begins and ends; here the grooves come central with the rim.

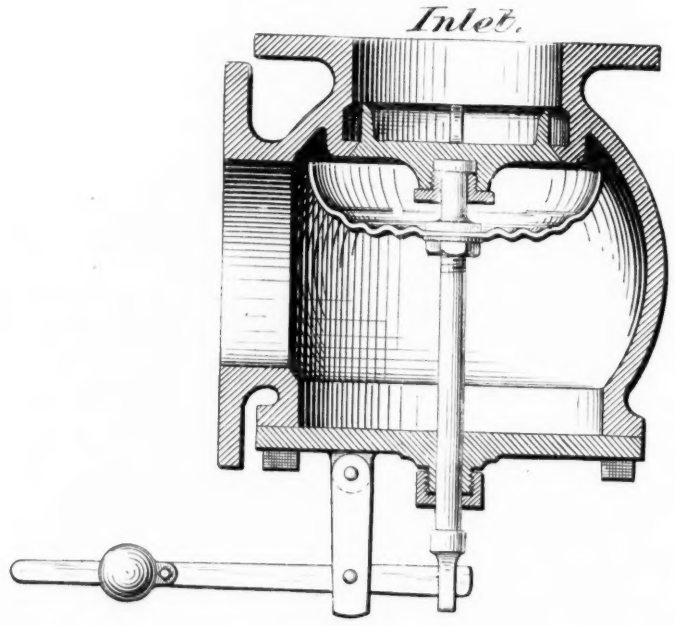
In the last wheel the cores, with the exception of the two full cores, will go either end first.

The Kieley Back-Pressure Valve.

The engraving represents a back-pressure valve for use in exhaust steam heating. While the arrangement is such that any desired amount of back pressure may be carried, the sensitiveness of the valve is such that it is said to open and close with a variation of not more than one pound pressure. It will be observed that there are no stuffing boxes, and that the released pressure acts through the diaphragm in such a way as to make very little friction. The diaphragm is made of either sheet copper or vulcanized rubber, as circumstances may require.

Where live steam is used with exhaust steam for heating purposes a sensitive, reliable and tight back pressure valve is especially essential, as with a leaky valve the live steam will escape with the exhaust instead of being held in the heaters or heating apparatus.

This valve can be made as a globe valve, and can be used on either vertical or horizontal pipe. The manufacturer is Timothy Kieley, 11 West 13th street, New York.



Back-Pressure Valve.

Friction of Marine Engines.

Engineering publishes friction diagrams from the compound engines of the S. S. Stepney, cylinders 27 inches and 50 inches diameter, with stroke of 33 inches. Piston valves are used. The diagrams were taken in the erecting shop, and making allowance for 7 to 8 horse-power to work the pumps, gives the friction of the engines, running light, as 6 to 7 per cent. of the full power. Experiments made some time since with triple-expansion engines, built by the same firm (William Gray & Co), show that the unloaded friction of the three-crank engine is $2\frac{1}{2}$ to 3 per cent. less than that of the two-crank.

The Use of Files.

The following from the *Jewelers' Circular* contains some good advice on the subject, applicable to others than jewelers:

"A new file should be invariably used first for working brass, German silver, etc., as only a new file can be used for these metals. When no longer good for brass, it becomes excellent for filing steel, and at this degree of wear it is useful for a long time. It cannot be avoided sometimes, however, to use a new file for steel, and in such a case it must previously be oiled well, so as to prevent filling up with steel filings. This lodging of the filing dust is frequently the cause of the breakage of the teeth of new files. It is also easily caused by too firm a pressure, and this should be moderated as much as possible, when using a new file, otherwise the extreme ends of the cuts, which effect the filing, will chip off. These broken glass-hard chips of teeth generally bury themselves in the metal filed, and assist in ruining the tool altogether.

"Again, use a file so long upon one side, until this is no longer effective, and then use the other side; by this you have the advantage that you can always count upon one sharp side in cases of emergency. Workmen will frequently use the same file alternately upon steel and brass; this is fundamentally wrong, however, because after it has once been used on steel it is no longer good for brass. If blue hard steel is to be filed, which will occasionally occur, mainly use old worn-out files for first filing; you will invariably find some effective places in them—either on the point, or tail end, or sides. Many watchmakers take a pride in always exhibiting a set of new files; this is a proof, however, that they do not understand how to wear them out completely, while others boast of having performed a certain piece of work with worn-out files. To say the least they are no practical workmen, because the little they have saved by not purchasing new files is lost twenty-fold in the extra time consumed in doing the job. A good workman will not only have good, but he will also have worn-out files—a sign that he understands how to use them."

Kellock & Galbraith, Glasgow, Scotland, have recently built a plate planing machine which they describe in a letter as follows:

"The table or bed plate is 40 feet long by 3 feet 6 inches broad, with the ordinary square holes in table for fixing the work; the bridge or bow is 45 feet long, and has an end bow at right angles to above 10 feet long, with the ordinary screws and nuts for fixing the plates to bed, with 2 patent lever grip pieces to bind the plate rigid to table at the end where both sides of the plate are planed. It has an ordinary lathe bed, 40 feet long, with very broad bearings. On this bed are two separate traveling tool boxes, that follow each other, viz.: If the plate be 38 feet long, the one cutting tool starts at the center, the other one follows it up from the end, each tool cutting 19 feet in length, so that the 38 feet plate is finished in about the same time as a 19 feet plate on an ordinary plate planing machine. The end cutting tool finishes the end of plate, say 5 feet broad, and has it finished before the two tools finish the one side of the plate. It has a Bessemer steel screw, with a flange coupling forged on same; also a 7 inch thrust journal; length of screw 44 feet, 6 inches diameter, $1\frac{1}{8}$ inch pitch, square thread. Gun metal nuts are 18 inches long, and are driven by belt pulleys, 37 inches diameter by $7\frac{1}{2}$ inches broad. Weight of this machine is about 40 tons, and is fixed on a concrete foundation, 60 tons in weight."

England levies more customs duties on its imports than any other country in Europe. In 1882, the last year for which the figures were complete, the amount of duties collected were as follows: Austro-Hungary, $12,750; Russian empire, $44,435; German empire, $46,745; France, $35,480,000, and Great Britain, $96,050,000.

Messrs. R. Stephenson & Co. are now manufacturing Garrett's patent locomotive weighing apparatus, which seems to be the quickest and simplest method of weighing engines. The apparatus consists of short and strong hydraulic cylinders with rams, which are placed, one under each wheel, on a planed, level, cast iron bed, such as is usually fitted to locomotive erecting or overhauling pits. The engine is then lifted by the crane and placed with the wheels perfectly central on the rams. The height of all the rams must be exactly the same, and for the purpose of adjusting this height a screw plug is provided on the side of each cylinder. The weight of the engine is then read off from pressure gauges, the total weight as well as the weight

on each pair of wheels being at once indicated. In shops where there are no cranes a special arrangement of side walls to the pit is made, and the rams are carried below the level of the rails. The rams are adjusted under the flanges of the wheels, and by means of a small hydraulic force pump the rams can in a very short space of time be raised so that the wheels are lifted clear of the rails, and at the same time are adjusted perfectly level The weights are then read off from the gauges as before. The gauges are made to register up to 5 tons on each wheel for light engines, and to 10 tons on each wheel for heavy engines.—*The Engineer.*

New Panel Raiser.

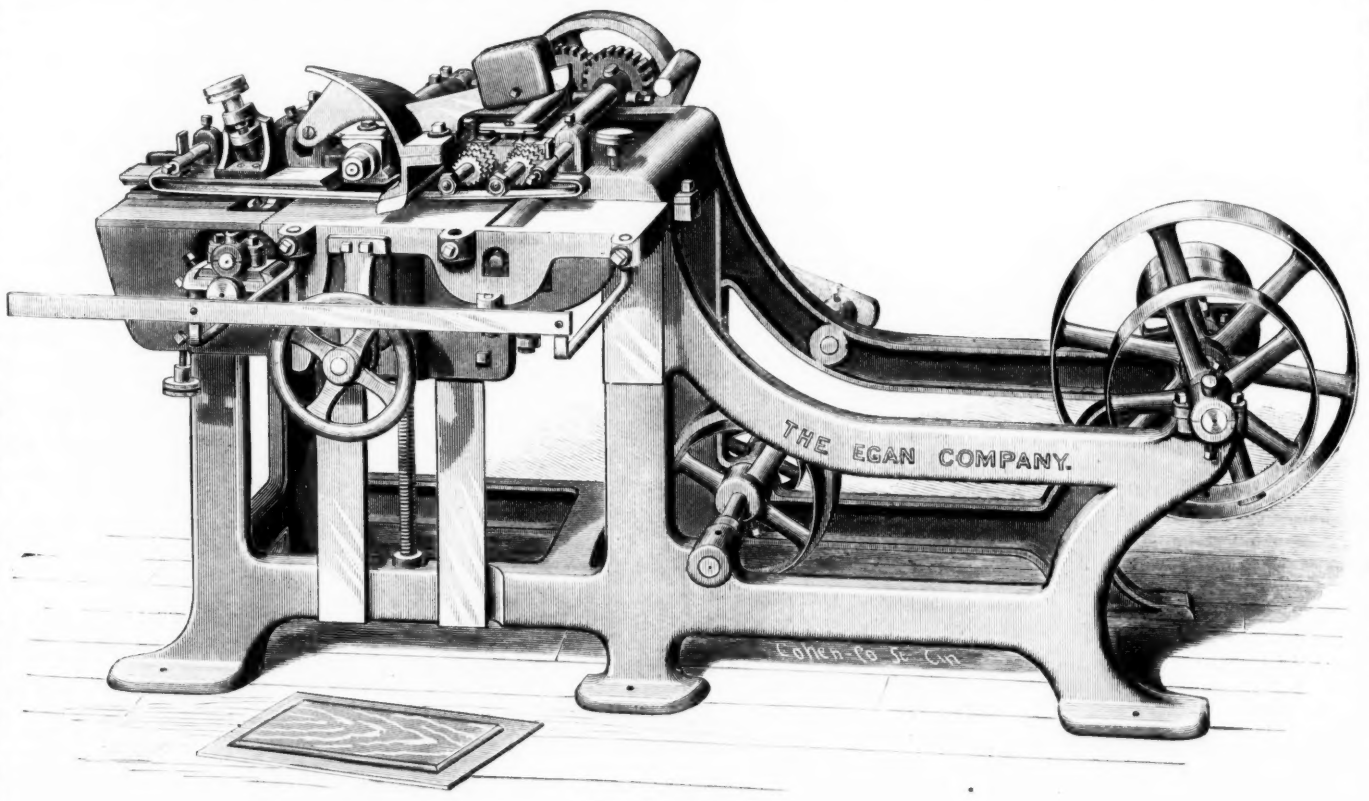
The engraving represents a new machine made by the Egan Company, Cincinnati, Ohio. This machine is a complete double panel raiser, with a self-feed, raising panels on both sides, and making all kinds of blind slats, sticking sash and door stiles, trunk strips, light mouldings, etc.

The mandrels are made of cast steel, running in self-oiling babbitt boxes; they carry two angle cutters for paneling, giving a shearing cut to the knife. The mandrel frames are each provided with a side adjustment screw.

There are two feed-rolls, which are set close to the front pressure-bar; they are held down by a spring regulated by a hand wheel convenient to the operator; an adjustment at the back end gives any desired lead to the feed-rolls.

The bed is raised and lowered by the hand-wheel in front, and is provided with an improved pressure foot and long spring; also with an extra fence for long panels. Access to the lower head is obtained by lifting off the end of bed, which part is also adjustable to regulate the depth of cut.

The machine will raise panels up to three inches on both sides, and by a change of heads wider panels and all kinds of sticking can be done.



New Panel Raiser.

Signals on British Railways.

Angus Sinclair, who spent a part of the summer in Britain, tells something about the way railroads are operated in that country, under the head of "Rambles on British Railways," in the *National Car and Locomotive Builder*. We make some brief extracts:

"Riding on a locomotive gives one a good opportunity for observing the methods, restrictions and details of train operating, and many of my notes were taken from that standpoint. Another good way of gleaning information I found to be that of standing round a junction where a great many trains were passing and branching off.

* * * * *

"There have been great improvements, or rather, elaborations, of the signal system introduced on many British railways since I was running on the Scottish North-Eastern Section of the Caledonian Railway twenty years ago. The signal system in use there at that time would to-day be considered elaborate on most American roads; yet it was merely the beginning of the perfected system now almost universally adopted. Every station or stopping place had a station semaphore signal, with arms and lights for the protection of trains standing on either track, and about half a mile distant from the station, on each side, were distant signals, operated from the station, and used to give approaching trains timely warning of the main line being obstructed at the station. When any train, regular or wild, passenger or goods, got within the protection of station signals, the train men felt assured that their charges were secure from being run into. An engine driver who attended closely to his business, knew every signal and where it could first be seen, and was continually on the watch for them. His eyes were not on the track, but in the air, searching for signals. That is the leading distinction yet between the British engine driver and the American engineer. To get his train safely along, the eyes of the latter are never off the track; the eyes of the former are directed to the point where the next signal is likely to appear.

* * * * *

"The goods trains now run on every British railway are controlled in a looser way than passenger trains were before the continuous brake was introduced. With the ordinary freight train the braking is done by the tender and one van at the end of the train. The newer types of goods engines are now getting driver brakes as an auxiliary means of controlling the train. Should a goods train run away going down a hill, the train men must wait passively till the level is reached, for they cannot apply more brakes, as the ordinary freight car has merely a lever brake that can be applied only from the ground, and the loose couplings used make passing over a train in motion a dangerous feat. There appears to be no movement leading to the adoption of continuous freight car brakes in Britain, so while the trains must be provided with a long space for stopping, an elaborate signaling system is an absolute necessity. We are away behind Britain in the signal service, but we are ahead on brakes. The question so much agitated lately, of why British railways are more expensive to operate than those of America, is easily answered."

It is rare to find among people well acquainted with electrical phenomena, theoretically or practically, any one rash enough, in the present state of knowledge, to hazard a definition, stating just what electricity is. Now and then such an attempt turns up. Here is the latest we have seen. "Electricity is the energy of molecular vibration caused by any disturbance of the normal attraction or condition of matter." This luminous definition appears in the scientific notes of an electrical journal of recent date—as a contribution, it is proper to say.—*Electrical Engineer.*

The entering classes at Tuft's college are smaller than usual, numbering 15 in the classical course and six in the engineering.

LETTERS FROM PRACTICAL MEN.

About Gears.

Editor American Machinist:

The following is an easy way to size a gear blank. If we have an eight pitch cutter and want a wheel of 30 teeth, we take 30 eighths for size of wheel on pitch line, and two eighths for size beyond pitch line, 32 eighths in all—or 4 inches. A wheel of 48 teeth will be 50 eighths in diameter, or $6\frac{1}{4}$ inches. Rule—One tooth for every eighth of an inch in diameter of pitch line, two-eighths added for whole or outside diameter.

Suppose we have 10 pitch cutters. Then a 30 tooth wheel will be 30 tenths diameter on pitch line—whole diameter 32 tenths. A 40 tooth wheel, 42 tenths diameter. A 36 tooth, 38 tenths diameter.

If we have 12 pitch cutters we must go by 12ths—making a wheel of 30 teeth 32 twelfths outside diameter. With 16 pitch cutters we go by 16ths—30 teeth requiring 32 16ths for outside diameter.

The above supposes we have Brown & Sharpe's cutters, or cutters made upon the diametrical system.

10 pitch cutters will do very well for back gears to lathe of 14″ swing. The change gears may be finer—say 12 pitch. Large or spindle gear may be $1\frac{5}{16}$″ or $1\frac{3}{8}$″ face—cone gear 1″ face. Change gears $\frac{3}{4}$″ or $\frac{7}{8}$″ face. For back gears we would need 2 cutters—No. 2 and No. 4—No. 2 cutting from 55 to 134 teeth, No. 4 cutting 26 to 34 teeth. For change or screw gears we would need at least 3 cutters—Nos. 2, 4 and 5. For fuller information refer to Brown & Sharpe's catalogue.

In sizing gear blanks we need to be quite accurate, as a too small diameter will give a thin tooth, and a too large diameter a thick tooth—both will work bad. A large micrometer caliper would be good for this purpose. But one can take the size from a good rule with common calipers. H. Norton.

Miscellaneous Shop Matters.

Editor American Machinist:

I have been very much interested in the articles in your valuable paper on pattern making and moulding, and I have learned something practical from them. But yet when the castings come out, there is a great fault in many of them. I don't know whether the fault is with the draftsman or pattern-maker. The moulder can, I think, plead innocent. The fault is in leaving the inside corners of patterns square, which is a sure bid for a crack. We have all seen these defects and yet it seems hard to get a remedy, although it is so simple. Just put a good big fillet in the corner and the shrinkage will not leave a weak, spongy place to crack off at the first strain I have always had them put in if they have to be planed, or chipped out afterwards. It pays; yet I know it is hard to make pattern makers think of it.

Another thing: I often notice men trying to grind brass cocks, valves, etc., with emery. It is one of the worst things to do, as the emery works into the soft metal and cuts it in ridges, and will continue to cut for a long time. A very excellent and cheap substance for grinding brass work is the dust turned off grindstones; it don't cost anything; I have often seen men and boys trying to grind blow-off and other cocks, with the plugs vertical or up and down. This way will never make a good job, as the sand and oil will work down to the lowest part and grind faster than at the top part, and often by turning the cock upside down the bearing can be changed from one end to the other. It is best to grind them horizontally if it can be done.

I very often find good mechanics who never carry a rule; if asked for one they have lost it. Why? Because they have no pocket to carry it in. Sometimes it is in pants pocket, sometimes in hip pocket, and often in the drawer, when they are working some distance from it. A few stitches cut in the outside seam of pantaloons leg, and a pocket 6″ by $1\frac{1}{2}$″ inserted, the height just where the hand reaches when straight down, is no inconvenience, not seen and always handy. The same can be put in overalls.

Locomotive boilers often crack in the waist or throat sheet, as it is called, where the barrel joins the fire-box. There must be a cause for this. I think it is often caused by the expansion plates that slide on the frame, either getting choked up with dirt, or wearing a shoulder on frame which prevents the free expansion and contraction of the boiler, and this causes the crack.

A copper patch is often put on such a crack simply because it is easily fitted, being more pliable and better to fit on a crooked place, but copper expanding about 50 per cent. more than iron, it soon cracks in rivet or bolt holes and leaks again.

Soft plugs in the crown sheet of fire-boxes have long been used to detect low water, and save boiler from being burnt by putting out the fire. But it has been found that the soft filling in the brass shell will, by the action of the heat, become hard, and fail to melt, showing the need of changing them. Again, where the water used is very muddy, mud will often accumulate around the plug on top of crown sheet, the water not getting to the plug, it will sometimes melt very slowly, and if a very small hole gets through, the pressure of steam will soon cut the lead all out, then some one is hauled up for carrying low water.

I notice in your edition of October 9th an article from *Engineering*, of Mr. Anderson reading a paper before the British Association, speaking of the Lafite process of welding steel to iron as being a wonderful thing. I would just say when I was an apprentice boy in England, 35 years ago, such a thing as a solid steel hammer was very rare. All hammers were forged of iron and steel faces welded on. And I could tell him how to weld a steel face on an iron hammer without putting the steel in the fire, which is a more wonderful thing. J. J. Bingley.

Richmond, Va.

A Job of Shaft Straightening.

Editor American Machinist:

The other day one of the belts on the line-shaft ran off the pulley, and, catching between the pulley and hanger, wound around the shaft, and pulled things along with it considerably. By things are meant counter shaft, small hangers, shifter, pulleys, dirt, etc.

After the wreck was cleared away, it was found that the line-shaft was "sprung" about half an inch.

Twenty-one miles to a machine shop! Sending the shaft there was not to be thought of, for it could not be spared from the mill long enough to make the trip; running with it bent was equally out of the question. Examination showed that the bend was confined to a space of about six feet in a sixteen feet length. It was decided that the shaft must be straightened a little any way. So, while the men were taking it down, I went to the blacksmith shop to see what I could find to help me out. I found just what I wanted, some 2″ round iron, and a piece of 4″ round iron, about 3 feet long. Of the 2″ stuff I made two hooks, not much unlike the letter C, about 8″ long inside, by 4″ wide. These, with two steel wedges and a light sledge, completed the special tools for this job. Getting back to the mill, I found the shaft ready for me. Two V notches were cut in pieces of board, and nailed to some horses. The shaft, $2\frac{15}{16}$ in diameter, was laid in the notches, the horses very near the ends of the shaft. With a third horse to steady my hand when I wanted to hold the chalk, I began. The hooks were hung over the shaft, and the 4″ piece suspended therein. One of the wedges was driven into the space between the shaft and the 4″ iron, until judgment "guessed" it was about enough; and then the wedge was backed out, and the shaft turned by hand and tried. The operation was repeated until the shaft was reasonably straight. This job was done without removing the couplings, or pulleys, from the shaft; and I know that the job was fairly good, for after the shaft was back in place, before the coupling bolt was put in, I put three pieces of tissue paper between the coupling faces, equidistant around the circumference, and pushed the shafts together, all three pieces were tight, showing a presumably fair alignment.

I have thought many times since that perhaps that shaft could have been made all right without taking it down. If it could, two hours' time might have been saved. But the man who has to do unexpected jobs at short notice will not always hit the best way; he is fortunate, indeed, if he does not sometimes fail to hit any way.

F. L. JOHNSON.

Waukesha, Wis.

Casting Face-Plates Face Up.

Editor American Machinist:

It has been the custom in foundries for years to cast face-plates with the face in the drag, instead of the face up. A short time ago I had some plates to cast, and the first one was moulded face down. After the cast was over and the casting taken out I found it bad. It was caused from sand dropping in one of the pockets where gaggers and spikes had to be used to secure the sand.

The next day I proposed to the moulder to mould it face up, but he did not think much about moulding a plate face up that had to be planed and to be made solid. But we made the trial and got as solid a casting as if it had been cast face down.

We did not run it the old style of running castings. We ran it two ladles up, and instead of using the ordinary gate pins for such work, we used about twelve or fourteen pieces of $\frac{1}{4}$-inch round bars for gate pins, and had a channel running all the way around the pattern in the drag of the flask, and cut the gates from the channel to the pattern. On the cope of the flask we had a basin running all around the top of the flask. So the iron was poured in the basin on the top of the flask and carried to the channel in the drag by being strained through the $\frac{1}{4}$-inch holes made by the small rods after they were pulled out.

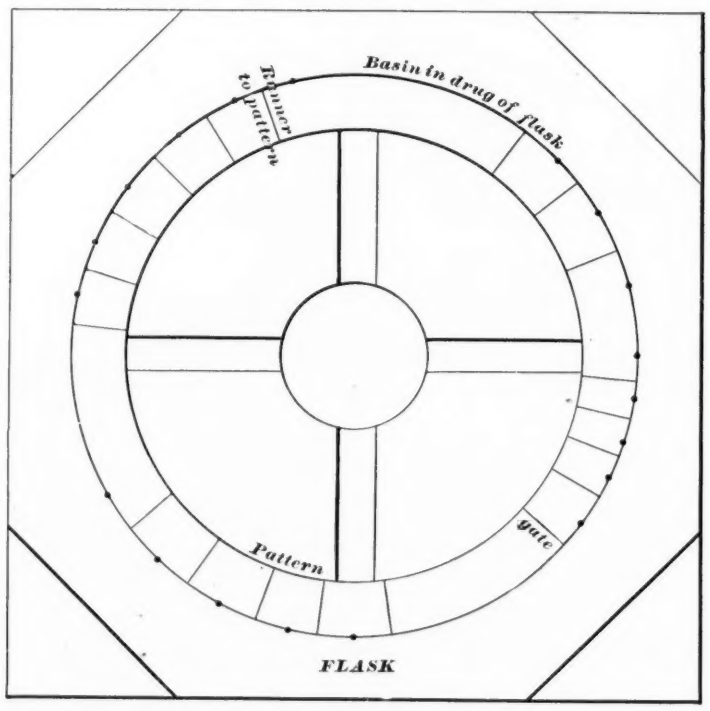
The result was a solid clean castings made in half the time of moulding in the old way.

DAVID SPENCE.

Faulty Designed Locomotives When it Comes to Repairs.

Editor American Machinist:

It is said that it is manifestly more easy to find fault with the work of others, than to improve on the work criticised. The writer proposes to name a few of these faults on some of our contract built engines, that would make them much better in service, and save many over-burdened foremen an endless amount of useless labor in repairs. Many of the minor failures of contract built engines are never brought to notice, hence they go on building and sending out the same. The C. H. & D. R. R. have six Mogul engines, two of which were bought in the past three months for the Dayton and Michigan division. Being taken from stock on hand, they are very good engines for a contract build, and may suit many master mechanics, still they lack many points in detail when compared to a company built engine. These last two Moguls referred to, came with cast iron saddles which began to break the first week they were put into service, and continued to break and be jacked up, until a new set of wrought iron



CASTING FACE PLATES FACE UP.

ones were put in, and every one of the six Moguls the first month in service broke the eye-bolt that supports the front end of equalizer, and comes up through pony truck center pin; the fracture each time took place at the lower end of thread. To overcome this trouble new ones were made and a split key $\frac{1}{2}$″ by $1\frac{3}{4}$″ is used instead of thread and two nuts.

The failure to put brass bushings in the back cylinder heads is a bad practice; the steam soon cuts the cast iron out too large for any kind of packing save that of hemp.

The writer finds in practice we must renew the pins in front and back end of reach rod, also bottom of reverse lever, about three times to one of any other part of the link motion, from legitimate wear.

I never could see just why a builder would put a parallel pin only $1\frac{1}{8}$″ diameter in front end of reach rod, with fork ends hardened, also lifting arm, and only one inch wide. I have seen these pins cut nearly in two, trying to support the vibrating motion of the reach rod. I do not know that I want a wrist pin for a reach rod connection, but I do want something larger in diameter and longer in bearing for wear than I have seen yet.

Another serious point on these Moguls, or any other engine constructed the same, is putting a hole clear through the followers. I saw our "cast-iron foreman" put in five solid hours trying to get one of these followers off last week; to say nothing of the contract with the standard oil company for coal oil to get one of these followers off, if the piston is in the engine, is a job that can not be done satisfactorily.

Some engines that were built some years ago by another works require some troublesome repairs. The driving boxes break right along on the corners of their flanges. The flanges are too light, while the flanges on the shoes are too thick and short; that is, do not project along the side of frame, and soon come loose and wear the jaws of the frame badly.

The standard shoe of the C. H. & D. R. R. Co. comes $3\frac{1}{2}$″ on the side of the jaws; with that depth they never get loose.

In some engines, if you want to put a liner back of the wedges, you must put the engine on the drop table, which arises from not putttng a slot in the jaws. Speaking of slots in frames reminds me that some locomotive builders slot their frames for spring hangers, which, in the opinion of the writer, is not the best practice, for they fill up with cinders, dirt and rust, so when you want to remove them it is a hard job.

The connection of valve stem to the yoke in some engines is a parallel, close fit, and key, which is a hard job to disconnect on the road in a hurry. The best connection I have ever seen for valve stem and yoke is made same as a lathe center, *i.e.*, a taper fit keyed up to a shoulder, and drift on each engine, to disconnect quickly when wanted, without battering up the valve stem.

A few cross-heads seem to be designed wrong. With a 3″ pin you have $\frac{3}{8}$″ brass between pin and strap in front end of main rod. The brass is squeezed out of shape the first trip. It ought to have $\frac{3}{4}$″ or $\frac{7}{8}$″.

Perhaps some of your readers may think the writer finds too much fault with contract-built engines. However, it is not intended in the sense of fault finding, but to bring out discussion on the above named points, which every practical railroad man knows do exist.

RALPH E. STATE.

Lima, O.

Stern-Wheel Steamer.

Messrs. Forrestt & Son, of Britannia Yard, Millwall, E., and Norway Yard, Limehouse, London, E., have lately constructed for an African river a stern-wheel steamer of the following dimensions: Length over all, 75 feet; breadth, 13 feet 6 inches; depth, 3 feet, with a draft of only 15 inches with six tons of cargo, fuel, and equipment on board. The hull is built entirely of galvanized Siemens-Martin steel, and is divided into five water-tight compartments with steam bilge ejectors to each compartment to discharge any water that might accumulate from leak or otherwise. A wood awning covers the vessel completely, and is supported on galvanized iron stanchions. Accommodation for officials is provided for in a large mahogany deckhouse on main deck forward of boiler space. The cabin is luxuriously fitted up with cushioned seats, broad enough to be used as sleeping berths when required; the rest of the furniture is of polished mahogany. The pantry is at the fore end with all necessary conveniences; the sides of the house are fitted up with venetians instead of glass, to give as much ventilation as possible, with sun blinds outside. There are also curtains all round the vessel to be used at night time. The main deck is of light steel covered with linoleum. The two balanced rudders aft are connected by an iron rod and worked from a steering gear placed forward of the deck-house, the steersman being clear of all deck obstructions, and by means of a gong can communicate with the engineer aft at will. There are three cargo hatches—one to each hold—giving every facility for working cargo. The windlass is on the ratchet principle, with hand lever for working anchors. The vessel is fitted all round with galvanized steel wire arrow guards, extending from deck to awning, to protect officers and crew from the frequent attacks of hostile natives. A very compact galley is situated on main deck aft.

The engines are of the high-pressure type; cylinders 11 inches diameter by 30 inches stroke, and work direct on the stern paddle-wheels. The paddle-wheels are 8 feet 6 inches diameter, and so arranged that they may be raised or lowered to suit different drafts of water. The boiler, which is placed amidships, is of the field vertical type, working pressure 120 lbs., and having large heating and grate surface for burning wood fuel. The machinery is capable of indicating 75 horse-power, and the speed of vessel, with cargo and equipment on board, ten miles per hour. The vessel was built, machinery fixed on board to the entire satisfaction of the owners and their engineer, taken to pieces and packed in cases of not more than 60 lbs. each, with the exception of a few parts of the machinery, and delivered within seven weeks from date of order.—*The Engineer.*

A Small Model Locomotive.

A small locomotive and tender was exhibited in our office by its builder, Mr. F. Van Fleet. We believe that this engine is the smallest of its kind that has been made, in which all the different parts of the machine are so perfect. It represents the regular American type of locomotives, namely: Four wheel connected, and four wheeled truck. It is also equipped with all modern improvements. Complete system of air brakes, both automatic and straight on drivers and tank. It is built to a scale of $\frac{3}{8}$ of an inch to one foot.

Its principal dimensions are: Length of engine, 12 inches; length of tender, 7 inches; height over all, $5\frac{1}{2}$ inches; diameter of cylinders, $\frac{9}{16}$ of an inch; stroke, $\frac{7}{8}$ of an inch; driving wheels, $2\frac{1}{4}$ inches in diameter, and engine truck wheels $\frac{3}{4}$ of an inch in diameter.

Head light is $\frac{5}{8}$ of an inch diameter, and will burn oil for one hour. Signal lamps are half an inch long, and will burn oil for twenty minutes. Steam gauge will indicate a pressure of 100 pounds. Weight about 15 pounds. This locomotive can be fired and run the same as any ordinary engine, and either oil, coal or coke may be used. The proportions of the mechanism seem to be very good, and we are informed that the internal arrangements of the different are also perfect.

If any of our readers wish to obtain a correct idea of the delicate work required to build such an engine, we would advise them to draw for instance, a gauge cock to a scale of $\frac{3}{8}$ of an inch to one foot, and then attempt to make one of the same size as that on the drawing. By so doing we believe the reader will obtain a better conception of the work required, than can be obtained by a long description. Mr. F. Van Fleet deserves great credit for the skill, perseverance and patience displayed in making this engine, although we do not wish our friends and readers to under-

stand that the time spent in building so small an engine is well spent. A young man who wishes to become a thorough mechanic will have no time to spare for such work, and the energy, pluck, perseverance and patience that he must display in order to become a master of his profession, will be more than that required for building the smallest locomotive that can be built.

New Monkey Wrench.

One of the points of merit claimed for this wrench is that the bolster outside the milled nut for turning prevents the screw from springing. The ferrule is also long and solid, making the wrench stiff; the ferrule is strongly riveted to the handle.

The nut is deeply corrugated, making it easy to turn the screw. The material is wrought, and the wrenches are made either case-hardened throughout, not case-hardened, finished bright, etc., to suit the wants of purchasers as to price and quality.

G. T. Moore, 112 Chambers street, New York, is introducing these wrenches.

The Sweetland Chuck with Pulley Clamp Jaw.

The utility of the improvement shown in the engraving will be plain to those who have tried to hold thin-rimmed pulleys, wheels, rings, and similar articles firmly enough in a chuck to bore and turn them without springing the rim. To avoid the springing a good deal of time is frequently spent in clamping such work to the face-plate.

The operation is apparent. The jaws are run out against the inside of the rim sufficient to hold but not to spring it, then the set screws are set down on the outside of the rim. By this means the pulley or other piece can be held as firmly as desired without springing out of shape.

The improvement does not interfere in any way with the ordinary use of the chuck.

The manufacturers are the Hoggson & Pettis Manufacturing Company, New Haven, Conn.

The Ives Process of Photo-Mechanical Engraving and its Usefulness to Engineers.

EXTRACTS FROM A PAPER READ BEFORE THE AMERICAN INSTITUTE OF MINING ENGINEERS, BY ROSSITER W. RAYMOND.

The various modifications of the art of photography have become within the last few years the indispensable allies of every art and science. But, before the introduction of the process which is the subject of this paper, there was, so far as I am aware, no satisfactory means by which certain photographic negatives could be made to yield, without the intervention of the skilled draftsman, electrotypes suitable for surface-printing. I refer to negatives taken from originals, such as natural objects, photographs or lithographs, in which the lights and shadows are not represented exclusively by lines and dots, such as can be photo-engraved.

The greater usefulness to engineers and manufacturers of electrotypes as compared with lithographs is evident. The electrotypes can be kept indefinitely and used in the production of many thousand copies. They can be duplicated at trifling cost. They can be placed for printing together with the "forms" of type, or included in these, upon an ordinary press. Finally, they are cheap, when made mechanically from a suitable original. Various methods have been adopted for the preparation of such a secondary original (as it might be called) in cases where the first original is unsuitable for photo-engraving.

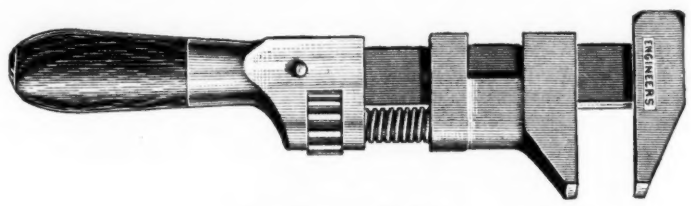
The purpose of the Ives process is to prepare mechanically, and therefore accurately and cheaply, what I have called the secondary original. Bearing in mind that the problem is, to obtain from an original having smooth shades a copy in which these shades have been translated into lines or dots, like a line or stipple-engraving, we cannot but admire the simplicity and ingenuity with which this end is effected.

The process is described in two United States patents, No. 237,664, dated February 8th, 1881, and No. 245,501, dated August 9th, 1881, both issued to Frederick E. Ives, of Philadelphia. The principle is the same in both; and the improvement described in the later patent will be pointed out presently.

The perfected process, as now practiced, beginning with the photographic negative, comprises the following steps:

1. A gelatine film sensitized with bichromate of potash, is exposed to light under an ordinary photographic negative. It is then placed in cold water, which swells it into relief, highest where the negative was most opaque.

2. A cast in plaster is then taken from this wet gelatine relief. The surface of the cast is uniformly white, but is high where the picture should be black, and low where it should be white, with every gradation between.

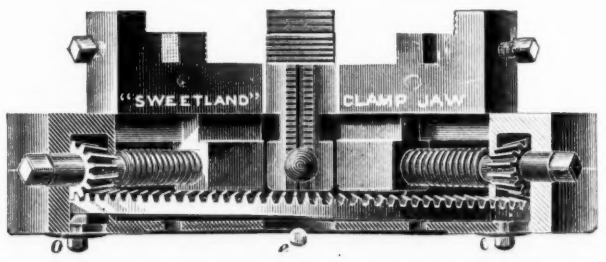


New Monkey Wrench.

3. An elastic stamp of V-shaped lines or dots is inked and pressed against the relief until the flattening of the lines or dots causes them to make an even black impression on the highest parts. The ink dots are then very minute on the low parts of the relief, increasing in size on the higher parts, until they meet to produce the even black impression on the highest parts.

4. Relief printing-plates are made from the ink-stipple picture, by transferring it directly to zinc, and etching into relief by the chemigraphic method.

The first, second and fourth of these steps are not new. The object of the first and second is simply to obtain a relief-plate of the same character as that employed for the "Woodbury type," namely, a relief in which the lights and shades of the original are represented by variations in altitude—a reverse of the gelatine relief. Any other method for making this relief might be employed; but probably the one above described is the quickest and cheapest. The fourth step also may be replaced by any other method of photo-engraving. It is the third step which constitutes the essence and the novelty of this process, namely, the preparation of the secondary original.



The Sweetland Improved Chuck.

The difference between the first and the second patent above cited is in the material of the "elastic stamp." In the first patent this was proposed to be made of paper, corrugated in lines, or pressed into raised dots. The second patent substitutes "printers' roller composition or equivalent elastic composition."

Imagine a sheet of such material, impressed or engraved with two sets of equidistant parallel and similar V-shaped troughs at right angles to each other, the troughs of each set being so close together as to cut away nearly all the original surface. Obviously all that is left of the original surface is a great number of points, which are the apexes of adjacent tetragonal pyramids, and are regularly placed in equidistant rows. These tips receive the ink, and impart it to the white relief-plate formed by the second step. This operation is performed in a simple, ordinary press, on the bed of which the relief is placed, and the inked sheet, held in a folding frame, is shut down and pressed upon it. Experience has determined the proper relation between the fineness and depth of the stippling on the stamp, and the materials employed, and also the degree of pressure to be applied. Of course too great a pressure would tend to blur the result, by flattening the inked pyramids against the relief. From inspection of numerous samples from this process, I infer that the pressure applied is just enough to make the points of the pyramids touch the bottom of the deepest depressions in the relief. This inference is based on the circumstance that I have never found in "Ives" prints any spots absolutely white or free from stippling; that is, I have never seen such a print in which the points of any of the inked pyramids of the elastic stamp were not represented. The resultant effect in the prints themelves is a soft, gray "tone," which is very agreeable.

On the other hand, the proportions of the relief and of the stipple-stamp are so calculated that the pressure which causes the tips of the pyramids to barely touch the bottoms of the depressions is sufficient on the tops of the highest elevations of the relief to flatten these tips until, approaching one another, they print upon the plaster a continuous black shade. It should be noted also that the regular distance between these tips, which is thus diminished by pressure upon the elevations, is more or less increased by the same pressure over the depressions in the underlying relief, so that the dots left in these depressions are not only small, but further apart than the regular distance.

It is, indeed, surprising to see with what delicate fidelity this simple device adjusts itself to any inequality of the relief-surface, a fidelity comparable only with that of the gelatin-film itself, from which the relief is obtained. When the elastic sheet is removed, a picture in stipple is left upon the plaster, representing with astonishing accuracy every shade of the first original, and this second original now becomes the subject of further photo-engraving.

The usefulness of this process for such publications as the *Transactions* is very clear. For line drawings we usually employ the so called "wax process." The original is transferred (by photography, if reduction of scale is required) to a surface consisting of a thin layer of wax on a polished copper plate, and redrawn with a stylus in the wax, after which an electrotype is taken from the wax intaglio. This process involves, it is true, the labor of redrawing the original; but that may be regarded as an advantage, since it secures a desirable uniformity in the style of the plates of our *Transactions*, and indeed, but few of the original drawings that come to the secretary are so well executed that they could be photo-engraved directly. Moreover, the wax process permits reduction of scale much better than photo-engraving or photo-lithography. Many drawings could be reduced in scale without injury to the essential details, but they are so made that the unessential details, or rather, the details which are independent of scale, such as the *hachure*, the thick and thin lines, and the lettering, will not bear reduction. When such drawings are reduced by photographing on the wax surface, all such details can be redrawn without reference to scale. Shades in parallel lines are put in with a ruling machine; lettering is put in by pressing type into the wax. Corrections can be made in the wax with great facility. A hot iron is held over the error and it disappears, leaving a smooth, new surface for the correction. Finally, the electrotypes taken from the wax are exceptionally well defined. The lines, having been drawn down to the copper plate, are all deep, and equally deep, and conversely the depressions on the electrotype are deep and equal. Such electrotypes are especially adapted for the rapid printing of large editions. They are superior in this particular to those produced by the various photo-engraving processes (zinco-types, etc.), among which the Ives plates must be included. These need careful press-work, and may even require special paper and hand-printing. The excellence of Mr. Garrison's illustrations in Volume XIV., already mentioned, is very creditable to the printers of the Institute.

The cost of the wax process for simple line work is not greater than that of the Ives process for its special class of work. Neither process can take the place of the other. Together they cover nearly all the needs of engineers and engineering publishers where colors are not required. Simple photo-engraving from line or stipple originals is cheaper than the wax process, and may be used when the originals are very finely and suitably executed. Wood engraving, which is dearer than either, is nearly superseded for such purposes. Even in the realm of higher art it is hard pressed by the various mechanical processes. *Harpers' Monthly* and the *Century* have published many Ives plates of wonderful delicacy and beauty, and a couple of years ago, when this process was comparatively unknown, Mr. Clarence Cook, a leading art critic of New York, got himself into a ludicrous embarrassment by praising the engraver of a certain picture in one of the illustrated books of the Harpers, calling him by name, recognizing his skillful touch, and the thought and feeling which he conferred in the block upon the otherwise inferior work of the artist—when it turned out that the block was an Ives electrotype, and consequently a purely mechanical reproduction of the artist's sketch, without the intervention of the great engraver or of any other.

Accidents from Machinery.

The master's obligation is not to supply the servant with absolutely safe machinery, or with any particular kind of machinery; but his obligation is to use ordinary and reasonable care not to subject the servant to extraordinary and unreasonable danger. When a master employs a servant to do a particular kind of work, with a particular kind of implements and machinery, the master does not agree that the implements and machinery are free from danger in their use, but he agrees that such implements and machinery, to be used by such servant, are sound, and fit for the purpose intended, so far as ordinary care and prudence can discover; * * * and the servant agrees that he will use such implements with care and prudence. If under such circumstances, harm or injury come to the servant, it must be ranked among the accidents, the risk of which the servant must be deemed to have assumed when he entered into such service. * * * Neither companies nor individuals are bound, as between themselves and their servants, to discard and throw away their implements or machinery, upon the discovery of every new invention which may be thought or claimed to be better than those they have in use; but if they take ordinary care and exercise ordinary prudence to keep their implements or machinery in sound repair, so that harm does not result to the servant for want of such sound condition of the implements or machinery used, then such individuals or companies will not be responsible to servants for any injury which may occur to them in the use of such implements and machinery.—*Lake Shore and M. S. Ry. Co. vs. McCormick*, 74 *Ind.* 445.

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NEW YORK, OCTOBER 23, 1886

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A Shop Economy.

Some years ago Chordal described, in these columns, a new arrangement in "Bennett's Shop," which allowed every machinist to press an electrical button, without leaving his machine, and thereby call a boy, who would wait upon him for anything required about his work. The plan worked well, and every machine could be kept steadily running. The boys were going about after tools, or delivering messages to foremen and superintendents, and doing just the same "chores" that skilled workmen would otherwise be spending the same time in doing. The pay of each boy would be about the same per week as that of a good machinist per day. A large shop so equipped would, therefore, save about five sixths of the regular pay of a skilled workman for every boy that could thus be kept actively employed. Every man running a machine is provided with cards to write messages upon, so that there need be no mistake in delivery. Simple and economical as this system is, we have never seen it used in more than two establishments. One is the Niles Tool Works, of Hamilto , Ohio (which was referred to as Bennett's shop, by Chordal), and the other the North Star Iron Works, of Minneapolis. Neither of these machinery works could be induced to drop that system. It pays substantial profits, and the original investments were quite small. An electrical battery, an annunciator and a roll or two of wire would furnish quite a large plant. The advantages of speaking tubes, or telephones, to connect the different departments of a machinery establishment with the main office, are widely known and appreciated. They are used in the shops above mentioned as auxiliaries to the electric call system, but cannot take its place. In these days of close competition and small profits, it is a wonder that more shops do not adopt such simple and money-saving devices.

Among the numerous questions sent to us for answer none come more frequently than those about learning to draw. In this week's issue we begin a series of articles by J. G. A. Meyer on "Learning to Draw," and shall continue them regularly from week to week. Mr. Meyer does not assume that his readers have any knowledge of drawing, but begins at the beginning, and will make the subject plain to all those who will carefully follow him through. He is not only a master of the art of mechanical drawing, but has the faculty of imparting a knowledge of it to others.

Plans for Saving Money.

A member of a machine tool manufacturing firm in Indiana sends us the following letter:

Editor American Machinist:

No. 41 AMERICAN MACHINIST at hand. Among other interesting reading, "Facts About Savings Banks" seems very timely, but fails in one respect, viz: If a working man has savings, after reading the above article, he will have a very uncertain feeling about the banks in general, and will not want to deposit his money. The same person will not want to keep it in his pocket or at home, especially if in a boarding house; and not knowing where he could get good notes to shave or be a party to start a savings bank, he would say, where can I put my surplus earnings? Or perhaps what is the use of trying to save anyway? and spend it for beer, cigars, etc. It seems as though this subject ought to be ventilated enough so working people could understand where to find a safe place for savings if there is one. Please ask through your columns some of the wise men, so they will tell us what they know about plans of deposit for savings. W.

The writer of the above letter does not seem to understand our object in directing attention to the lack of security in savings banks. We point out the evil in order that it may be remedied, and that the unsuspecting may examine the security offered before giving their savings into the control of others. The suggestion that if workmen do not place their surplus in a savings bank they will spend it for beer, cigars, and the like is not worthy of much consideration. Savings banks are plentiful and well patronized in the East. In the West they are few and generally small, yet the Western workmen are no more inclined to beer, cigars, and extravagance than Eastern workmen. On the contrary they appear, so far as our observation extends, to accumulate property as fast as workmen in any other section. Long ago they observed that real estate forms the basis of most savings bank investments, and some of them started a plan for making their own investments in that line. Building and loan associations were organized in various localities and have now extended to all parts of the country. They are under control of those depositing their money and borrowing of them for the purpose of owning real estate and erecting buildings thereon. The members can deposit small amounts, and, as shareholders, get the profits of the business when dividends are declared.

There are other good methods for workmen to save money which may be discovered by inquiry. There is no need for "wise men" to devise new plans of deposit, for it is better to trust those that have been tried and not found wanting. Workmen spend a great deal of time and labor to save something, and it is desirable that they should spend some time and study in finding safe and profitable means of investing it.

There seems to be a good demand for boilers. Several prominent boiler makers are well supplied with orders, and each thinks he is doing a little better business than any of the others. May the activity continue.

We hear of one large manufactory of engines, boilers and general machinery that is running twenty hours every week day, with orders ahead enough to last until the 1st of January. We also hear of several other shops that are running overtime.

Our correspondent, J. A. Hill, of Pueblo, Colo., writes us:

"I left my engine February 1st, and started the *Double Header*, which I edited until June 1st, when it became the *Daily Pueblo Press*. I am business manager, as well as publisher, and do most of my local editing, so you see I have my hands full."

The *Press* is a live paper, and deserves success. The editorial heading announces that it is the "leading Democratic paper in southern Colorado," and the "only evening telegraph paper in southern Colorado." Mr. Hill says he likes running on a locomotive rather better than conducting a daily newspaper; but this may change after he gets into an active political campaign. He promises that our readers shall hear from him again at the first opportunity.

A Useless Consular Report.

Austria has recently revised her tariff, in the interest of protection. A protective tariff has been in force in the United States for the last quarter of a century; yet Consul General Jussen, representing this country at Vienna, seems to think it a part of his duties to decry protection. In his report to the State Department on tariff revision in Austria he says:

The reasons furnished by the Government for the increase of the tariff have failed to satisfy the opposition, and the arguments upon which these prohibitive tariff rates are based, are severely criticised, and mercilessly analyzed, by a portion of the public press.

In other words, there is a small party in Austria, just as there is in the United States, that is opposed to the National Government policy of protection, and makes a great deal of noise about it. Under cover of what "is urged" by somebody unknown, Consul-General Jussen gets in the following stinging thrust at protection on manufactures:

As to increased protection of manufactures, it is urged that a worse time for this venture could not possibly have been chosen. That in times of universal depression, and in the midst of a crisis, the industries of a country cannot be artificially nursed by a high protective tariff, and that a wise government would have awaited peaceful times and universal prosperity; and that the inevitable result will be a new burden for the consumer, not for the benefit of the State, but for the sole profit of a few industrial proprietors.

After giving expression to this heap of information, he terminates his report, which from beginning to end is nothing more than a furious criticism of the Austrian Government for adopting an economic policy, such as our own Government has had in force for twenty-five years, having started it in a season of war, crisis and depression. It is apparent that Consul-General Jussen is not a fit representative of the American Government.

As business improves manufacturers of machinery begin to realize that a mistake has been made in cutting prices to the extent that has been done in many branches. After prices have been reduced abnormally low to meet competition and slow demand, it is always found a hard matter to get them back as the demand increases. The demand is for more goods, but not for higher prices. In the steam-engine trade prices are quite too low, but it is easier to sell a good many engines at current prices than it is to get a fair price for one. Manufacturers are considering how they shall get back to fair prices, but it is a difficult thing to do. The productions of different builders differ, and no standard price can be agreed upon, as it might be on a yard of cloth or a bushel of potatoes. There are other branches of the machine trade similarly circumstanced. Perhaps next time they will be slower to reduce prices.

A reader in Indiana asks for the "most sure and speedy way to get employment as fireman on some railroad." He says he has written to several master mechanics, "but receives no attention from them whatever." He has read all the books he could procure on locomotives; also the articles in the AMERICAN MACHINIST. Let him go direct to some railroad shop and tell the master mechanic what he wants. Nobody would engage him by letter to fire a locomotive.

In the machine business conservatism is likely to lead to skepticism. There is wide difference between the two. Conservatism prevents rushing into untried paths, making changes for the sake of changes, while skepticism condemns everything untried. Conservatism sticks to old methods until there is fair evidence of the value of new ones. It does not keep old tools and machines in use in the shop if good reasons for the adoption of new ones are at hand. Conservatism condemns schemes for getting power for nothing from impossible engines and boilers, because there is no reason at the back of it; at the same time it throws out the old engine and puts in one of modern construction.

There is no satisfactory place for the pure skeptic. It is always unwise to condemn a device or plan because it is new and startling. There are many things yet to be learned, and some of them will come along with startling suddenness. But reasonable conservatism is the only safeguard against unbalanced opinions and ideas.

We have frequently written in favor of the formation of mechanics' and engineers' clubs for the purpose of mutual improvement. Such clubs have in a number of instances been formed, and some of them are doing excellent work. Others, we are sorry to say, have been broken up or crippled by foolish internal dissensions. As such clubs increase in membership and importance, it is necessary to establish rules for government, and right here is where the trouble begins. The members do not understand the importance of yielding to the will of the majority. It is a fact, and it is not creditable, that when mechanics or engineers unite for the most praiseworthy purposes, the last thing they learn is that the majority must rule, and that the minority should submit, so long as no question of absolute right or wrong is involved. Very frequently they never learn this, and associations that might do much good go to pieces in consequence.

We read in English journals a good deal in the way of the relative merits of English iron and American wooden cabs for locomotives. The general opinion in this country is that English locomotives have no cab such as an American engineer would tolerate, that is, if the cab is considered in some sense as a protection against the weather.

QUESTIONS AND ANSWERS.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly, and according to common-sense methods.

Every question, to insure any attention, must invariably be accompanied by the writer's name and address. If so requested, neither name, correct initials nor location will be published.

(368) C. S., Cleveland, Ohio, writes: 1. I have a slide-valve engine 10½″x12″, cutting off at four-fifths stroke and running at 200 revolutions. I make the mean effective pressure a little more than 73 lbs., and the horse-power 57. Am I right? *A.*—You do not give the boiler pressure. The best guess we could make is that, if your engine is working fairly hard under a governor, the mean effective pressure may be half the boiler pressure. The mean net area of a 10½″ piston would be, say, 86 inches; the piston speed is 400 feet per minute; hence, at 73 lbs. mean effective pressure, the horse-power would be:

$$\frac{86\times73\times400}{33000}=76$$

2. Is 8 to 1 the best proportion of grate to stack? *A.*—The proportion will depend upon the height. You will find an article explanatory of this in the AMERICAN MACHINIST of March 27, 1886. 3. What number of pounds of coal is it considered the best practice to burn on each square foot of grate? *A.*—Ten to 12 lbs. of hard coal, or 15 to 20 lbs. of soft coal is fair practice.

(369) A. F. D., New Orleans, La., asks: 1. What is the best lubricating oil for shafting, 7″ or 8″ diameter? *A.*—On general principles, sperm oil is probably the best. But sperm oil is costly, and cannot always be had. Lard oil is a very good substitute, or prepared oil, mostly mineral oil, will probably give satisfaction. It depends largely upon the pressure. By giving the necessary particulars, any reputable dealer will supply you with something that will give satisfaction. 2. What is the best oil for cylinders? Is tallow good? *A.*—Our advice is that you do not use tallow. You can buy mineral oil specially prepared, called cylinder oil, that will be satisfactory.

(370) A. F. W., Woonsocket, R. I., asks: 1. We have an engine 16″x36″, with 5-inch exhaust pipe. The engine runs 54 revolutions. We use the exhaust steam for heating the factory. We are going to put in a Berryman heater. Which will give the best results—one 24 inches diameter and 8 feet long, or one 36 inches diameter, 12 feet long? *A.*—The builders of the heater can give you exact information on this point. We have no doubt, however, that the larger heater is better suited to the size of engine, and will give better results than the small one? 2. Is there any economy in using exhaust steam for heating the factory? *A.*—Yes, if properly arranged.

(371) W. G., ——, writes: I have a shaft upon which are two pulleys, which we will call *A* and *D*. The circumference of *A* is 9 feet 3⅛ inches, and the circumference of *D* is 4 feet 8⅛ inches. From *A* I drive a roll, *C*, 36 1-10 inches circumference, by means of a pulley on the roll, the pulley being 9 feet 9 inches in circumference. This pulley we will call *B*. I have another roll, *F*, 4 ft. 8 3-16 in. in circumference, upon which I wish to put a pulley *E*, to be driven from *D*, so that the velocity of the two rolls at their peripheries shall be the same. How can I calculate the circumference of pulley *E*? *A.*—Reduce the feet and inches to inches and decimals of an inch; then divide *A* by *B*: = 111.5 ÷ 117 = 0.953. Multiply this by *C*, 0.953 × 36.1 = 34.4033. Divide this by *F*, 34.4033 ÷ 56.1875 = 0.612. Divide *D* by this, 56 5 ÷ 0.612 = 92.32, the circumference of pulley *E*. To prove you are right, divide *A* by *B*, and multiply by *C*; also divide *D* by *E*, and multiply by *F*. The two results should be equal. By extending the decimals, you will get a trifle closer result.

(372) S. P., St. John, N. B., writes: 1. We have two boilers 56 inches diameter and 28 feet long, with two 14-inch flues in each. They help to supply a 28″ ×48″ stroke cylinder. What size tubular boilers will it take to replace them? *A.*—Tubular boilers, 48 inches diameter and 16 feet long, fitted with 3½-inch tubes, would have rather more capacity. 2. Would they do for rolling mill with heat from the furnace? *A.*—Yes. Tubular boilers, 44″ diameter, 14 feet long, fitted with 3-inch tubes, would probably make as much steam, as the flue boilers, but we should prefer 48-inch shells, 16 feet long, fitted with 3½-inch tubes.

(373) B. B., Leadville, Col., quotes from Roper's Catechism some instructions for reversing the motion of an engine, and asks: Are they right? *A.*—No. All wrong. Your understanding of the matter is right.

(374) W. R., Minork, Ill., asks: 1. How can I set the lathe centers to turn exactly parallel? *A.*—We were taught, when an apprentice, to turn a short distance on one end of the piece, then change the piece end for end in the lathe without altering the tool. If the tool touched alike both times, we thought we had the lathe set right. We cannot undertake to recommend any special make of small tools.

BUSINESS SPECIALS

Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Wednesday for the ensuing week's issue.

Send stamp for souvenir. Mechanics, 5 Dey, N. Y.

Shafting Straighteners. J. H. Wells, Tampa, Fla.

Patent Att'y, H. W. T. Jenner, Washington, D. C.

J. Clayton, Air Compressors, Rock Drills, 43 Dey st, NY

Edw. Sears, Wood Engraver, 169 William st., N.Y.

Steel Name Stamps, etc. J. B. Roney, Lynn, Mass.

Selden Packing, for stuffing-box, with or without rubber core. Randolph Brandt, 38 Cortlandt st., NY

The Best Upright Hammers run by belt are made by W. P. Duncan & Co., Bellefonte, Pa.

Light articles built to order by the American Sewing Machine Co., Philadelphia, Pa.

R. Dudgeon, 24 Columbia st., New York, Improved Hydraulic Jacks and Roller Tube Expanders.

Pattern and Brand Letters. Vanderburgh, Wells & Co., cor. Fulton and Dutch sts., New York.

20″, 25,″ 28″ B.G. and S. F. upright drills for immediate delivery. Currier & Snyder, Worcester, Mass.

The best wire nail and tack and nail machinery. Wm. A. Sweetser, Brockton, Mass.

Ice and Refrigerating Machines. 120 built, and all successful, by David Boyle, 521 Monroe, Chicago, Ill.

Rubber Belting, all sizes, 77½ per cent. regular list. All kinds of Rubber Goods at low prices. Jno. W. Buckly, 156 South street, New York.

For Best Return Steam Traps, Pressure Regulators, Positive-Acting Pump Govs., Back-Pressure Valves. T. Kieley, 11 W. 13th st., N.Y. Send for des'n.

Curtis Pressure Regulators, Curtis Return Trap. Curtis Damper Regulator. See Oct. 2, p. 15. Send for circular No. 17. Curtis Reg. Co., Boston, Mass.

Engine Lathes, Hand Lathes, and other fine tools, Assortment large; prices low. Frasse & Co., 62 Chatham st., N. Y.

Machinists' supplies, brass goods m'f'rs supplies, polishing materials, all kinds wire, metals, etc; in any quantity. Jordan & Gottfried, 208 Canal st., N.Y.

Draftsman's Adjustable Curve Ruler; makes any curve; sold everywhere F. W. Davenport, Mfr, Providence, R. I. Circulars gratis.

"Hints to Steam Users, Engineers and Firemen." A 100-page book on care of steam boilers; just issued; containing useful rules, tables, etc; a valuable book for engineers; sent on receipt of 25 cts. in stamps. J. N. Mills Pub. Co., 30 Vesey st., N. Y,

To the Mason Regulator Co., Boston.—The two pressure regulators are doing more than you claimed, and I recommend them to all who want an even pressure and a No. 1 regulator. F. E. Keyes, Supt. Conant's Indurated Fiber Ware Factory, Watertown, Mass.

St. John Improved Self-adjusting Cylinder Packing, for marine and stationary engines and locomotives; applicable to water, air, oil and ammonia pumps. For durability and minimum of friction, it is unexcelled. Send for pamphlet. Address, Balance Valve and Piston Packing Co., room 58, 280 Broadway, New York.

Patent Binders for the AMERICAN MACHINIST, holding a complete volume (52 issues), simple, neat, durable. Price $1, prepaid, to any part of the United States by mail. To Canada or foreign countries the price will be 75c.; purchasers pay express charges and customs duties. AM. MACHINIST PUB'G CO., 96 Fulton st., N. Y.

"Indicator Practice and Steam Engine Economy." By F. F. Hemenway. Contains plain directions for using the indicator, and making all required calculations from the diagram; also the principles of economy in operating steam engines, and current practice in testing engines and boilers. Price, $2 post-paid. Published by John Wiley & Sons, 15, Astor Place, New York.

MANUFACTURES.

David Mason will start a woolen mill at Athol, Mass.

It is proposed to erect an iron furnace at Selma, Ala.

Otis Barrow has almost completed a silk mill at Mansfield, Conn.

Walter Peak, Beaver Kill, N. Y., proposes soon to erect an acid factory to cost $10,000.

A. H. Osborn, Parkersburg, W. Va., is laying the foundation for machine shops.

J. H. Hartley, Montgomery, Ala., will erect large works for manufacturing boilers.

Chas. Keighley, Vineland, N. J., is erecting a new shoe factory.

The Johnson Harvester Company, Batavia, N. Y., are erecting two new buildings.

It is stated that the Florida Southern Railroad Company are enlarging their shops at Palatka.

Samuel F. Beach, of Morristown, N. J., will erect a new carriage factory on Bank street.

The construction of nail works will shortly be commenced at Watsontown, Pa.

Geo. W. Stewart & Co., Brookville, Pa., will start a shoe factory that will employ 125 hands.

William Slawson will establish a wagon and carriage factory at Dayton, Tenn.

The Webster, Camp & Lane Machine Company, of Akron, O., is increasing its capacity.

Sugg & Ormond will add a wood-working factory to their machine shop and foundry at Greenville, N. C.

The Rockland Silk Company, Paterson, N. J., will fit up the rink building at Meadville, Pa., for a silk factory.

The Westinghouse Electric Company is fitting up a large test room at its Pittsburgh, Pa., manufactory.

Nine thousand dollars have been subscribed by citizens of Oneonta, N. Y., for a proposed chair factory.

Henry Chastain is erecting a building on Oak street, Campbellsburg, Ind., to be used as a wagon manufactory.

The Narrow Gauge Street Car Company, of Des Moines, Iowa, have plans for repair shops to cost $10,000.

Ross & Baker, of Dover, N. J., will remove their silk mill to Port Oram, where they will begin the erection of a large mill.

Christian Baker, of Chicago, will erect an iron foundry at Archer avenue and Quarry street, 112x175 feet.

Horrocks, Lathrop & Foley, of Ilion, will soon begin the manufacture of furniture and type writers at Herkimer, N. Y.

The Enterprise Manufacturing Company, Akron, Ohio, is about to erect an additional building, and put in additional machinery.

The Chesebrough Manufacturing Company, of Brooklyn, will build an oil factory on Richard street, three stories high, to cost $4,000.

A company, with a capital stock of $500,000, is being organized at Nashville, Tenn., to establish large steel works.

J. L. Ludwig and George D. Smith, Richmond, Va., have bought the Bristol Foundry at Bristol, Tenn., and will greatly enlarge its capacity.

The New York Cancer Hospital will erect a three-story workshop, boiler-house and laundry on 106th street, New York, to cost $30,000.

M. E. Pratt, Prattsville, Ala., will improve the woolen mill property, and will, it is stated, use it for a grist mill and a woolen, cloth and cotton rope factory.

The Terre Haute Car Manufacturing Company, Terre Haute, Ind., are arranging a department for locomotive repairs, and are buying special machinery for that department.

Wm. Ayres & Sons, 313 Arch street, Philadelphia, have begun the erection of an additional hardware factory at the southwest corner of Third and Cumberland streets.

It is reported that a company, with a capital stock of $100,000, is being formed at Birmingham, Ala., to manufacture corrugated iron roofing, mineral paint, etc.

The Humphreys Manufacturing Company, of Mansfield, O., are erecting a two-story brick machine shop, 38x210 feet, and a one-story brass foundry and blacksmith's shop, 30x140 feet.

The Ketchum Iron Company—capital stock, $15,000—has been chartered at Fort Smith, Ark., to establish a foundry and machine shop, with Thos. Ketchum as president, and J. S. Park, treasurer.

The foundry of Fuller & Warren, at Schenectady, N. Y., was recently burned. The damage amounted to about $30,000. The firm has not yet decided definitely whether they would rebuild.

Monroe Ritchey and Robert P. Speagle are each building jug factories at Jug Town, N. C. As this town is strictly temperance, the jugs will probably be used for holding oil and molasses—nothing stronger.

The John Wilkinson Company, 77 State street, Chicago, have issued a new catalogue and price-list of foot lathes, scroll saws, chucks and machinery. It has 56 pages full of cuts and information.

A new corporation has been formed at Taunton, Mass., called the Taunton Woolen Company, for the manufacture of woolen and cotton goods; president, Henry H. Robinson; treasurer, John H. Eldridge; capital, $10,000, in 100 shares.

Richard P. Rothwell, editor of the *Engineering and Mining Journal* of New York, represents some capitalists who wish to erect two iron furnaces somewhere in the South. He has been prospecting in Alabama for a good location.

The Baxter Stove and Manufacturing Company has purchased land in Birmingham, Ala., for the purpose of erecting buildings for the manufacture of stoves and castings, with a capacity of 200 stoves per day.

The Florence Land, Mining and Manufacturing Company will be organized at Florence, Ala., with a capital of $800,000. The object of the company will be to erect a furnace, extend and build one or more railroads, etc.—*Baltimore Manufacturers' Record.*

A number of our contemporaries have noted that "a foundry is to be started at Auburn, N. Y., for the manufacture of high-speed engines." Whether the engine is to be turned out in one complete casting or in several smaller castings, is not mentioned.

President Pullman, of the Pullman's Palace Car Company, reports that the car shops at Pullman are turning out about $200,000 worth of work a week. The demand for cars, he says, is almost unprecedented, and the orders ahead are correspondingly large.

The McKeesport brass foundry, owned and operated by Messrs. Russell & Co., will be removed to Allegheny, Pa. The Pittsburgh and McKeesport brass companies have consolidated, and will erect a new mill in addition to their present one on Sandusky street, Allegheny.

The Zell Engineering Company has been recently incorporated, and has started business at 112 Liberty street, New York. They are contractors for steam and power plants, complete. Jas. A. Crouthers is president; Robert R. Zell, treasurer; and Franklin Van Winkle, secretary and consulting engineer.

By recent changes the James Jones Brass Works, St. Louis, have become the James Jones Manufacturing Company, incorporated. The capital stock is $24,000, half paid, and the incorporators and officers as follows: James Jones, president and treasurer, 160 shares; John McCargo, secretary, 40 shares; Henry Dietrich, vice-president, 40 shares.

The Kingsland & Ferguson Manufacturing Company, of St. Louis, have just issued their forty-second annual catalogue and price-list of engines, boilers, saw mills and other machinery. It is a 124-page pamphlet, well illustrated, and bound in a durable cover. A telegraphic cipher code for ordering goods of their own manufacture is appended.

Business at local machine shops is not to say dull, but is drooping. Among manufacturers generally, however, business continues to advance in volume, with probabilities of slightly better prices ahead. A new factory for the manufacture of light saw mills and improved wood-working machinery is talked of as among South St. Louis probabilities. —*St. Louis Age of Steel.*

The Baxter Electrical Motor and Manufacturing Company—capital stock, $200,000—has been incorporated at Baltimore, to manufacture electrical implements and machinery, with Benson M. Greene, James D. Mason, Jr., James F. Morrison, William Baxter, Jr., William V. Logan, Leopold Strouse and Samuel Rosenthal as directors. They are doubling the capacity of their present plant, and will employ 50 more hands. They contemplate erecting a large factory, to employ from 300 to 400 hands.—*Baltimore Manufacturers' Record.*

The Westinghouse Air Brake Company, of Pittsburgh, Pa., have published a new edition of their reference book, which illustrates their automatic brake, as applied to both passenger and freight rolling stock and their train-signaling apparatus. The book is replete with fine engravings and specific information for users of the brake. Many roads are applying the Westinghouse automatic brake to freight trains, it having been proved by over two years' use that its advantages are as great as when applied to passenger trains. It saves flattened wheels and brakesmen's wages; and, besides being a safeguard against accidents, increases the service that can be obtained from a given amount of rolling stock, by allowing a higher speed to be maintained with safety.

Among the recent orders taken by the National Water Tube Boiler Company for their water tube safety boilers (Moore's patent), we note the following: The Mount Vernon Mills, Baltimore, Md., 328 horse-power; Henry Welsh, New York, 210 horse-power; the Atlantic Refining Company, Point Breeze, Philadelphia, 328 horse-power; S. M. Breed & Co., Lynn, Mass., 100 horse-power; Little Falls Knitting Mills Company, Little Falls, N. Y., 100 horse-power; the Hallett & Davis Company, Boston, Mass., 120 horse-power; the Buffalo Wood Vulcanizing Company, Buffalo, N. Y., 200 horse-power; the Oneida Community (Limited), N. Y., 70 horse-power; the Pencoyd Iron Works, Philadelphia, Pa., 82 horse-power; St. Agnes Hospital, Philadelphia, Pa., 169 horse-power; E. E. Chapman, Syracuse, N. Y., 45 horse-power.

The Abendroth & Root Manufacturing Company of New York city, write us: We beg to report a most excellent business in both our boiler and spiral pipe departments. Among the recent boiler shipments, we mention: One 175 horse-power to Union Steel Screw Company, Cleveland, Ohio; two 102 horse-power, each to Duncan Salt Works, Silver Springs, N.Y.; two 154 horse-power, each to Ingenio "Las Canas," Cuba; one 125 horse-power to D. Appleton & Co., Brooklyn, N. Y.; one 128 horse-power to Ingenio "Recompensa," Cuba; one 125 horse-power to Ingenio "Lequertio," Cuba; one 217 horse-power to Ingenio "Nueva Paz," Cuba. Our spiral pipe machines just at present are busied on orders for our double galvanized flange pipe for exhaust steam-heating of mills and factories, and on orders for blower pipe for the new Croton Aqueduct contractors, to whom we have supplied up to the present time over 55,000 feet of pipe, from 10-inch to 14-inch diameter.

The following sales of boilers were made by the Babcock & Wilcox Company for the month of September: N. R. S. Yewdall, Philadelphia, 108 horse-power; Iowa Barb Wire Company, Allentown, Pa., 624 horse-power; New Jersey Iron Mining Company, Dover, N. J., 146 horse-power; Lehigh Coal and Navigation Company, Philadelphia, 208 horse-power; R. M. McCulloch, Cuba, 104 horse-power; Metropolitan Street Railway Company, Kansas City, 600 horse-power; J. H. Steinbergh & Son, Philadelphia, 82 horse-power; Old Dominion Steel Company, Richmond, Va., 184 horse-power; Mosle Bros., New York, for export to Cuba, 240 horse-power and 120 horse-power; Kansas City Electric Light Company, Kansas City, 127 horse-power; Standard Oil Company, New York, 416 horse-power; Department of Docks, New York city, 15 horse-power; Thos. E. Lutner, Philadelphia, 20 horse-power; East River Gaslight Company, Long Island City, 51 horse-power—making a total of over 3,000 horse-power for the month.

Machinists' Supplies and Iron.

NEW YORK, Oct. 7, 1886.

Iron—The market in American pig has shown signs of strength that indicate a possible advance in the near future. Standard brands, No. 1 X Foundry, have sold readily, at $18.50 to $19; No. 2, $17 to $17.50; Grey Forge, $16 to $16.50.

Scotch Pig—Better prices have been obtained for these brands. We quote Coltness, $21 to $22; Glengarnock, $19.50 to $20; Gartsherrie, $20 to $20.50; Summerlee, $20.50 to $21; Eglinton, $18.50; Langloan, $19.50 to $20; and Dalmellington, $19.50.

Lead continues to decline. Sales have been made at 4.40c., and in one or two instances at a slightly lower figure.

Copper—Lake, 11⅛c. to 11¼c.

Tin—Banca, in jobbing lots, has sold at 23c. to 23¼c.; Straits and Malacca, 22¾c.

Antimony—Hallett's, 7.60c. to 7.70c.; Cookson's, 8.90c. to 9c.

Spelter—Refined, 5¾c. to 6c.

✲WANTED✲

"Situation and Help" Advertisements only inserted under this head. Rate, 30 cents a line for each insertion. About seven words make a line. Copy should be sent to reach us not later than Wednesday morning for the ensuing week's issue.

Machinists, send address to L. S., AM. MACHINIST.

Good lathe hand wants job anywhere. Address Quick, AM. MACHINIST.

Wanted, at once—A few first-class tool-makers. Apply or address Brown & Sharpe Mfg. Co., Providence, R. I.

Wanted—Mechanical draftsman accustomed to general work; state wages expected and where last employed. Columbus Iron Works Co., Columbus, Ga.

Wanted—By a practical tool-maker and machinist, a position as foreman; have had large experience in handling men; best references. Address S. C., Box 5, AM. MACHINIST.

An experienced mechanical draftsman on general, special and automatic machine design desires a situation; Boston or vicinity preferred. Address Box 17, AM. MACHINIST.

A boiler shop foreman desires a situation as foreman or to lay out work, or would take a job piecework; knows how to work men and tools up to their full capacity; can make drawings and estimates; best references given. Address Jay E. Jay, AM. MACHINIST.

The undersigned would like to correspond with parties who may be in want of a man who is capable of doing fine and close work; is now foreman of a Canadian manufactory (been 14 years in present position), but his ambition is to advance to a more advantageous position. Address M. M., AM. MACHINIST.

Advertiser having made arrangements to represent two prominent manufacturers at the American Exhibition, to be held in London next year, would like to arrange with other intending exhibitors; can superintend the running of any machinery erecting, shipping and hauling; thoroughly acquainted with London. Address H. T. Roffe, AM. MACH.

A mechanical engineer, who is an able designer and draftsman and practical workman, and who has been accustomed to manage men, make out estimates and sales, wishes an engagement with a good firm; has had much experience with the Corliss engine, condensing and compound engines; also agricultural engines and general machinery. Address A. C. D., AM. MACHINIST.

Wanted—Foreman for machine tool department of a large stationary and portable engine works; must be a draftsman and familiar with valve movements and high-speed automatic engine work; must understand handling men; to the right person there is an opportunity to secure the position of superintendent of the establishment. Address, stating age, T. E. J., AM. MACHINIST.

✢ MISCELLANEOUS WANTS. ✢

Advertisements will be inserted under this head at 35 cents per line, each insertion.

Gerlach's Engineers' Specialties beat the world. Send for price list. Crescent Mfg. Co., Cleveland, O.

Crescent grease cup for shafting beats them all. Sample free. Crescent Mfg. Co., Cleveland, Ohio.

Light mach'y of all kinds built at short notice. Edmund Mills, 8 Dey st., Jersey City Heights, N. J.

Xperimental work for inventors; fine work and quick. LeRoy & Sharpe, 96 1st st., Br'kl'n, E. D., N. Y.

The best engines and boilers, ½ to 4 H.P.; economical in price, steam, etc. Washburn Engine Co., Medina, Ohio.

John Lamberty, mfr. telegraph and electrical instruments, experimental machs, models; fine gear cutting a specialty. 35 S. 5th st., Br'kl'n, E. D., N. Y.

Special tools and machines for mfg. designed and built to order; mechanical and Patent Office drawings. Weston & Smith, Syracuse, N. Y.

Wanted—Correspondence with party having marine railway to dispose of, by the K. of L. Boiler, Machine & Repair Co. Parke L. Poindexter, Sec'y, Norfolk, Va.

Experimental and new machinery for special purposes built by contract from specifications and inventors' designs; ample facilities. Cohoes Iron Foundry and Machine Co., Cohoes, N. Y.

For Sale—One 30 H. P. Fire-Box Boiler, good as new, $375; one Strange Automatic Barrel Stave Saw Mill, used but a short time; also a number of Portable and other Engines and Boilers. Address Ezra F. Landis, Lancaster, Pa.

✢ MISCELLANEOUS WANTS. ✢

Advertisements will be inserted under this head at 35 cents per line, each insertion.

Send for estimates of high-speed compound enginss for stationary and marine service. Crist Engine Works, 140 Baxter street, N. Y.

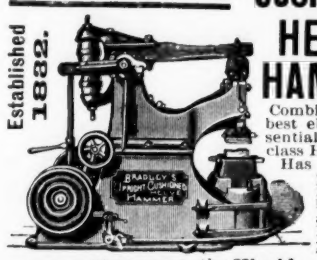
For Sale—The machinery, tools, plating apparatus and raw material of manufacturing establishment; now working on orders in brass and other metals; very low rent, including steam power. Address Manfr., P.O. Box, 285, New Brunswick, N.J.

For Sale—A first-class foundry and machine shop; large connection in saw-mill county in the South, including buildings, lots, machinery, and mills' supply stock on hand; business will be carried on until sold; reason for selling, retiring from business: apply at or address Southern Foundry, AM. MACHINIST.

For Sale—A well established foundry and machine shop, including lots, buildings, machinery, patterns, and stock on hand, situated in Logan, Hocking Co., Ohio; will sell on easy and satisfactory terms; reason for selling—old age and ill health. Apply to R. Belt, Logan, Ohio.

BRADLEY'S UPRIGHT CUSHIONED HELVE HAMMER

Established 1832.



Combines all the best elements essential in a first-class Hammer. Has more good points, does more and better work and costs less for repairs than any other **Hammer** in the **World.**

BRADLEY & CO. Syracuse, N.Y.

H. W. JOHNS' ASBESTOS ROOFING

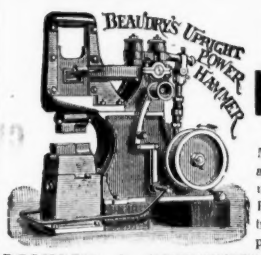
FIRE AND WATER-PROOF BUILDING FELT, FIRE-PROOF PAINTS, STEAM PACKINGS, BOILER COVERINGS, ETC.

Samples and descriptive Price List free by mail.

H. W. JOHNS M'F'G CO., 87 MAIDEN LANE, N. Y.

CHICAGO—PHILADELPHIA—LONDON.

BEAUDRY'S UPRIGHT CUSHIONED POWER HAMMER



The success of our Machine is the best guarantee of its value. Only machine with Double Helve. Does more and better work with less repairs than any other.

BEAUDRY & CUNNINGHAM, Boston, Mass.

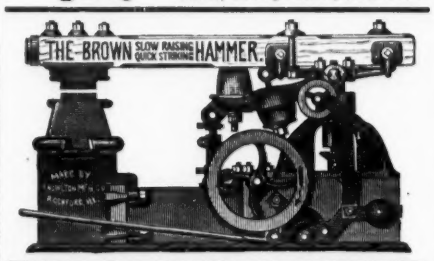
STEPHENS PATENT VISES.

50 PER CENT. OF time and labor saved by using this solid, strong, durable, quick-working Vise. Has the Improved Taper, Pipe and other attachments. Sold by the trade. Send for circular

MELVIN STEPHENS, Prop'r.

Office, 41 Dey Street, New York.

THE BROWN HAMMER



STRIKES A BLOW WITH

Double the Velocity That it Raises the Hammer.

A NEW MOVEMENT! SEND FOR DESCRIPTION.

Knowlton Mfg. Co., King St., Rockford, Ill.

GEO. F. BLAKE MANF'G CO.

BUILDERS OF EVERY VARIETY OF

95 & 97 LIBERTY ST., NEW YORK. 44 WASHINGTON ST., BOSTON.

WATER WORKS PUMPING **ENGINES A SPECIALTY**

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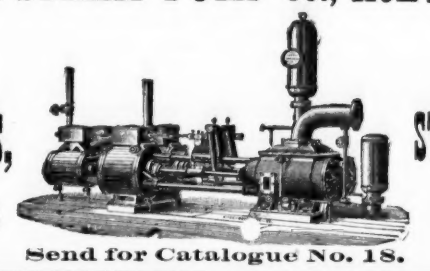
BUILD WATER WORKS, ENGINES AND STEAM PUMPING MACHINERY.



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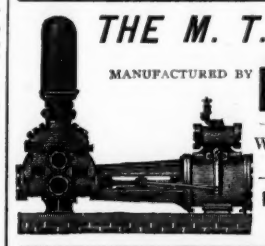

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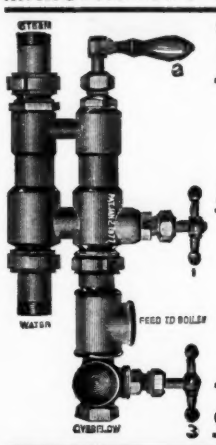

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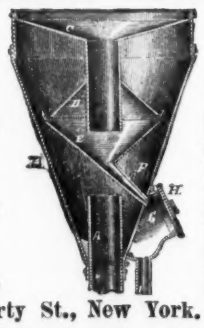

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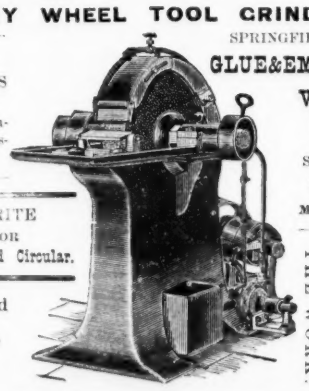

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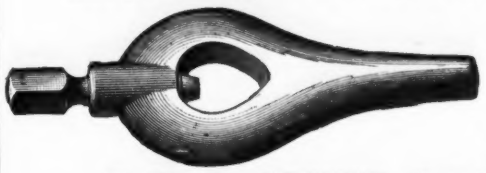

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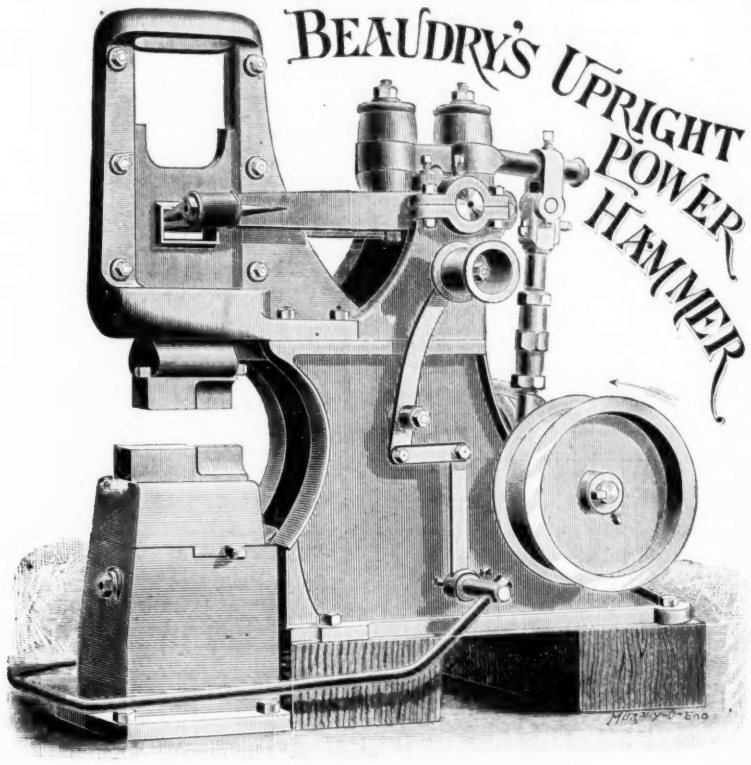

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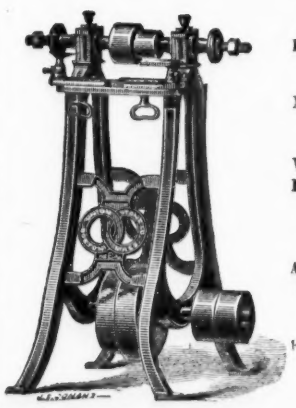

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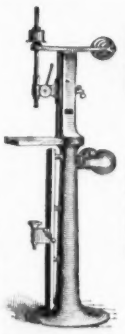

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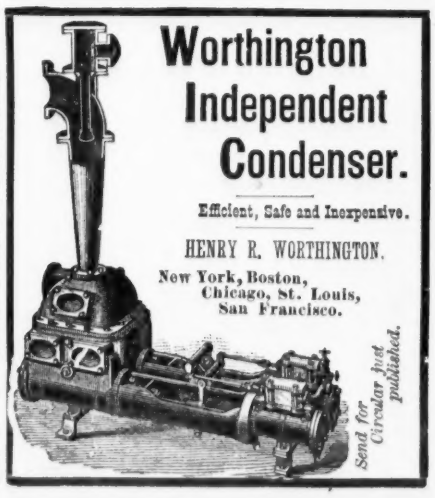

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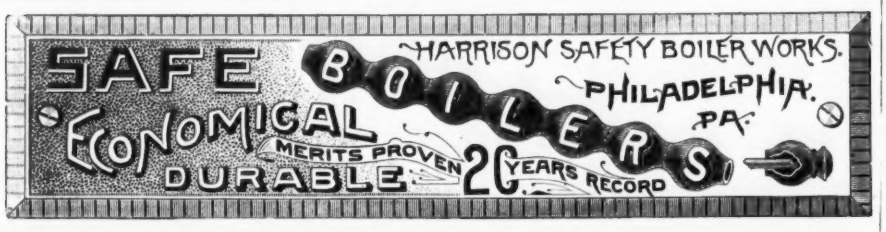

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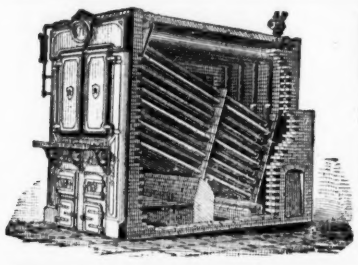

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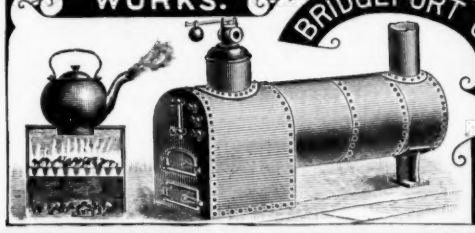

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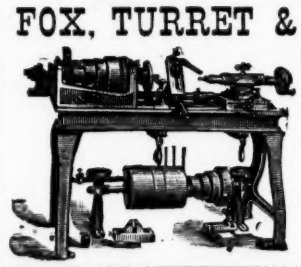

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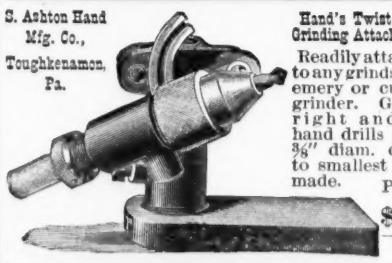

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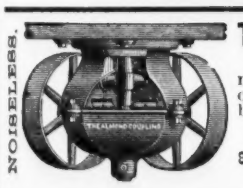

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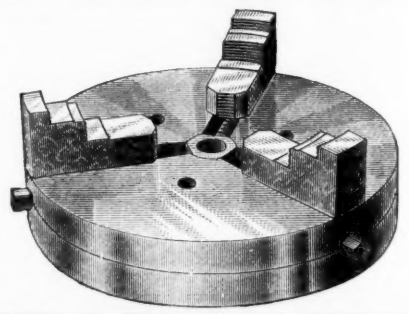

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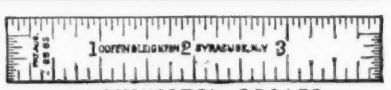

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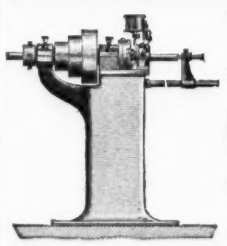

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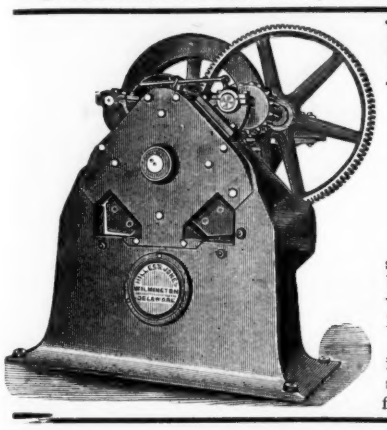

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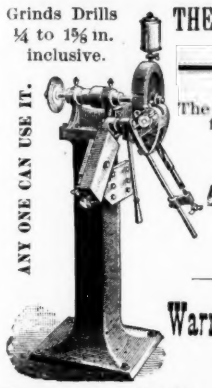

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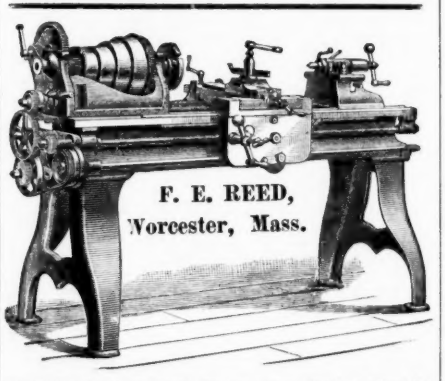

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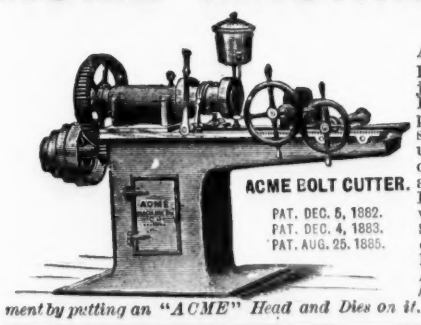

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PAT. DEC. 5, 1882.
PAT. DEC. 4, 1883.
PAT. AUG. 25, 1885.

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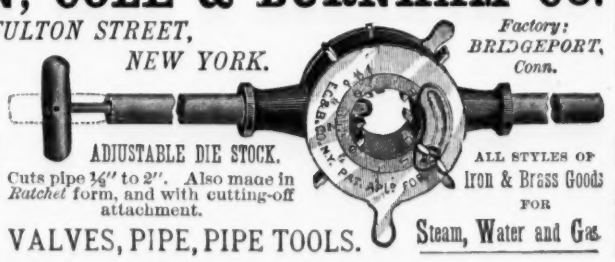

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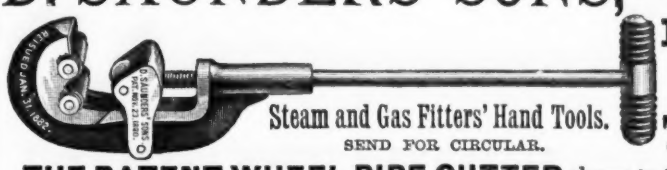

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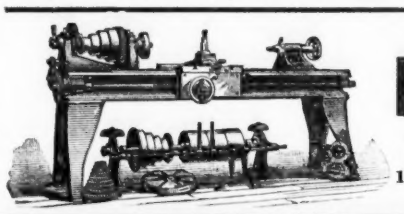

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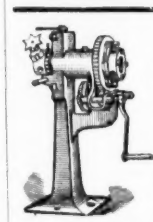

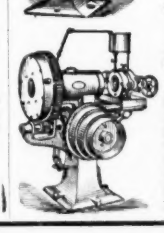

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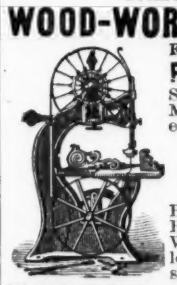

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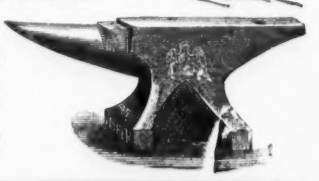

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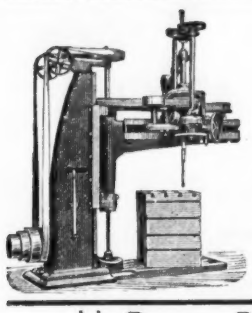

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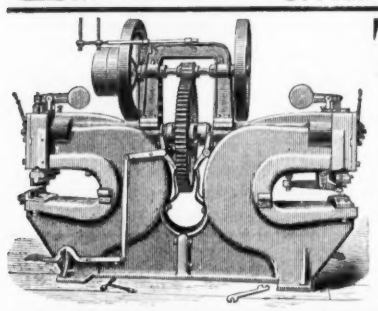

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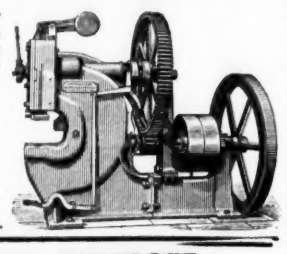

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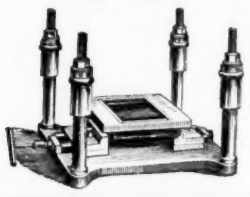

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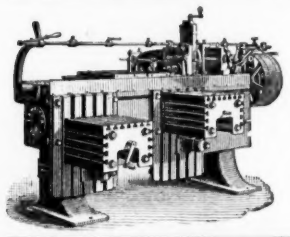

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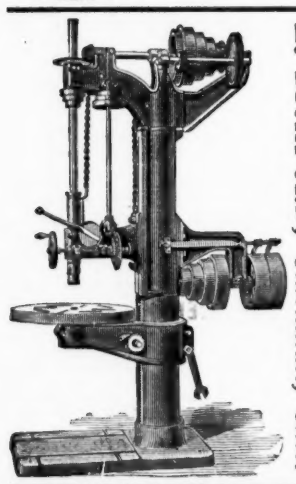

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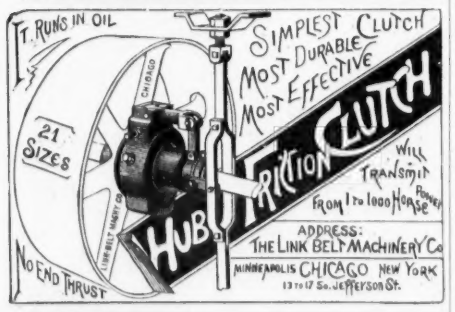

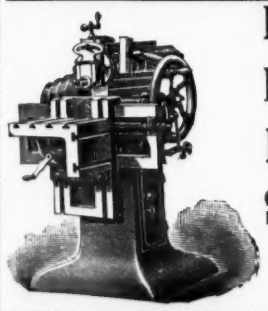

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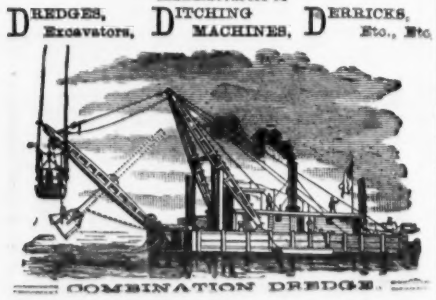

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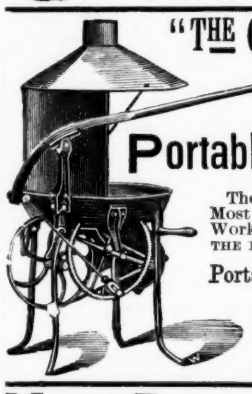

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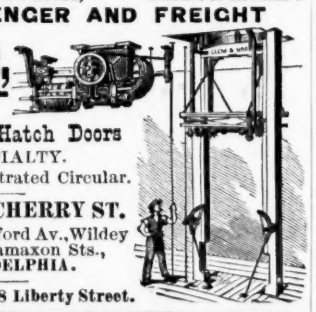

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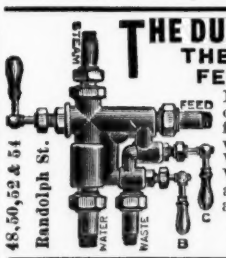

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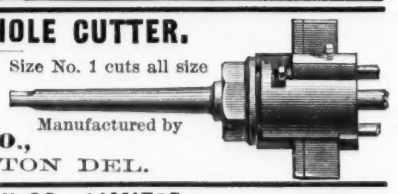

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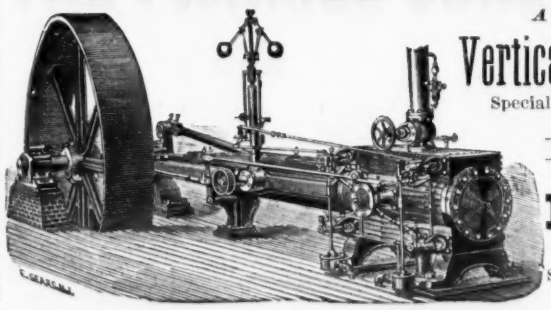

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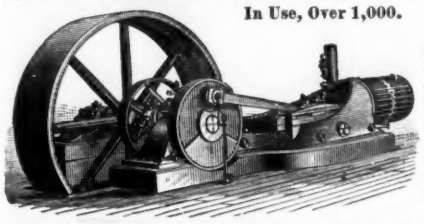
In Use, Over 1,000. 25 to 1,000 H. P.



These Engines are the combined result of long experience with automatic cut-off regulation, and most careful revision of all details. They are designed and constructed for heavy and continuous duty at medium or high rotative speeds. Highest attainable Economy in Steam Consumption and superior regulation guaranteed. Self-contained Automatic Cut-off Engines, 12 to 100 H P. for driving Dynamo Machines *a specialty*. Illustrated Circulars, with various data as to practical Steam Engine construction and performance, free by mail. **Address, BUCKEYE ENGINE CO., Salem, Ohio.**

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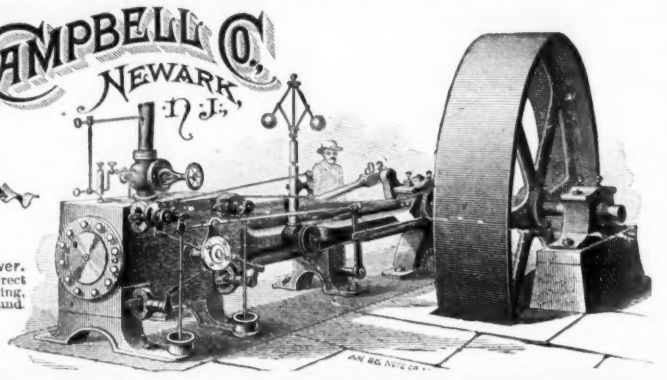

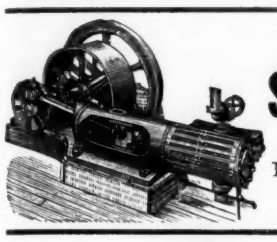

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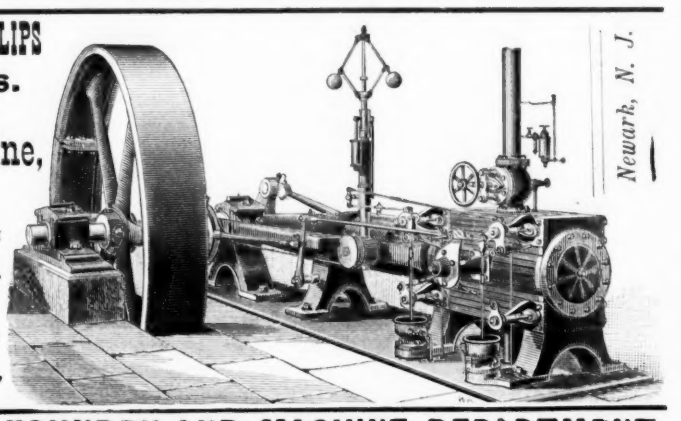

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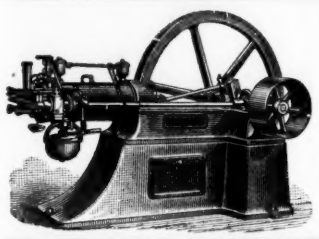

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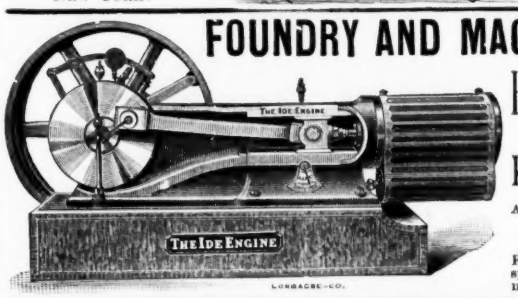

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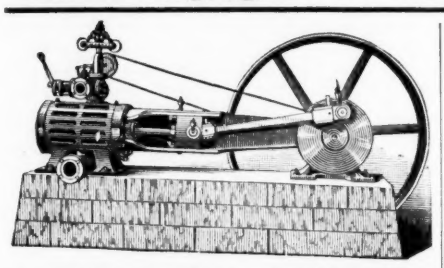

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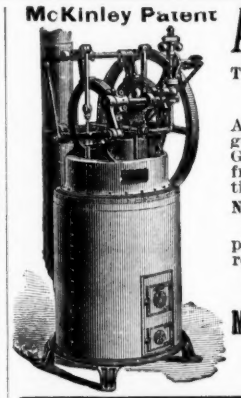

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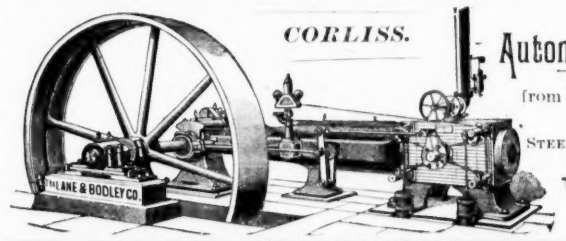

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STEEL BOILERS, FEED WATER HEATERS, SHAFTING, PULLEYS & GEARING.

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1 36 in. x 36 in. x 9 foot Planer, new design.
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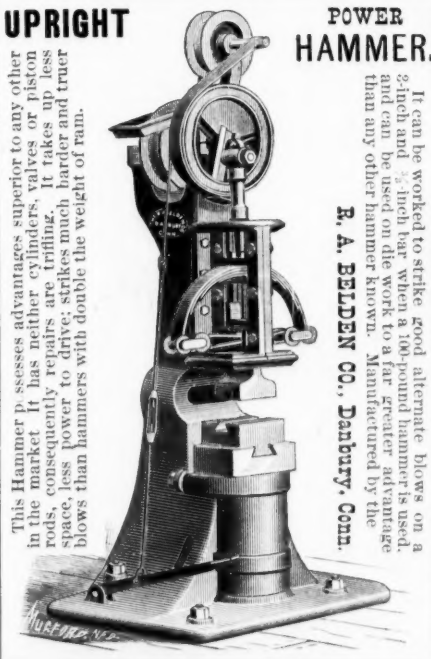

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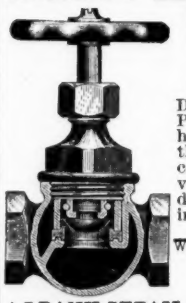

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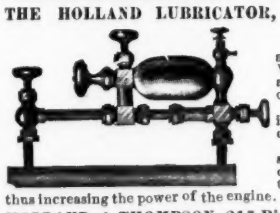

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19 " 10,12,14" " " " Pond, nearly new.
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16x6 ft. Turret Lathe with chasing bar.
14 in.-20 in. and 33 in. Turret Head Chucking. or Screw Machines, Bridgeport.
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20 in. Drill, Prentice.
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EXTRA HEAVY LATHE

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COLD-ROLLED SHAFTING, HANGERS, PULLEYS, ETC., ETC.

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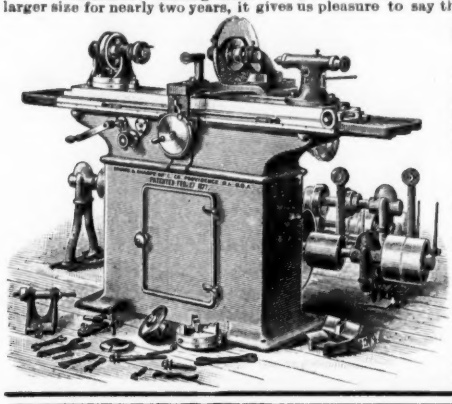

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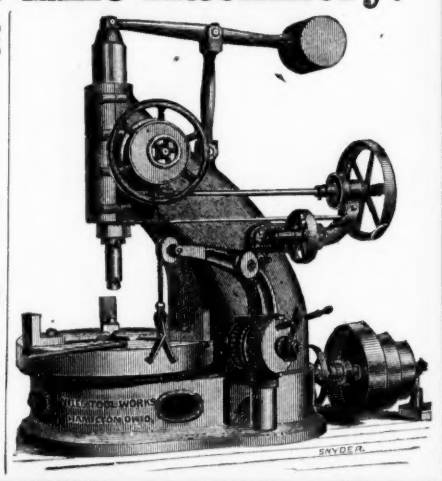

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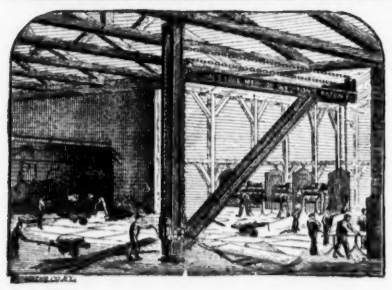

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FOR HAND OR POWER.

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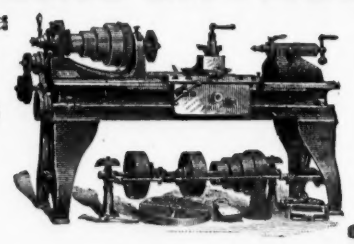

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(See our Advertisement on page 15.)

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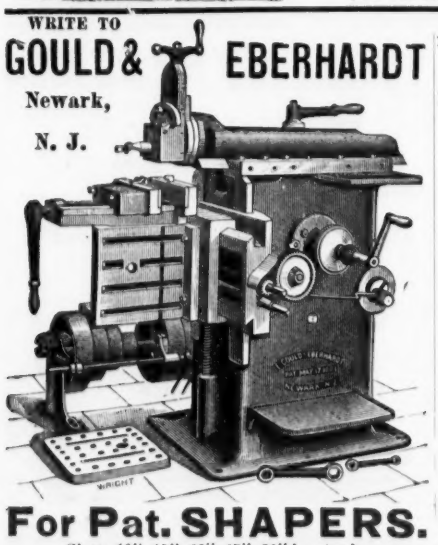

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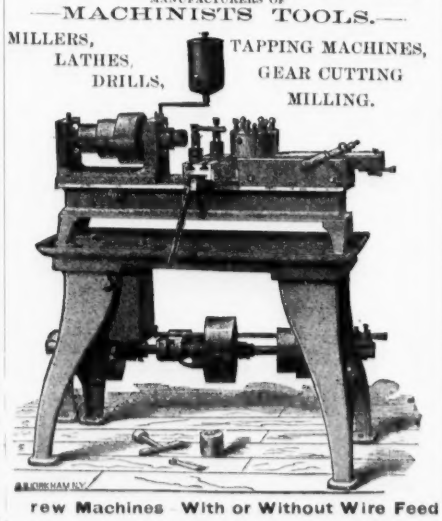

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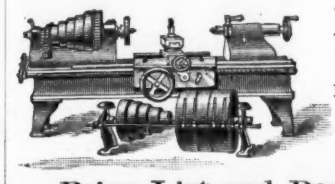

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STANDARD MACHINE WRENCHES
DROP FORGED OF
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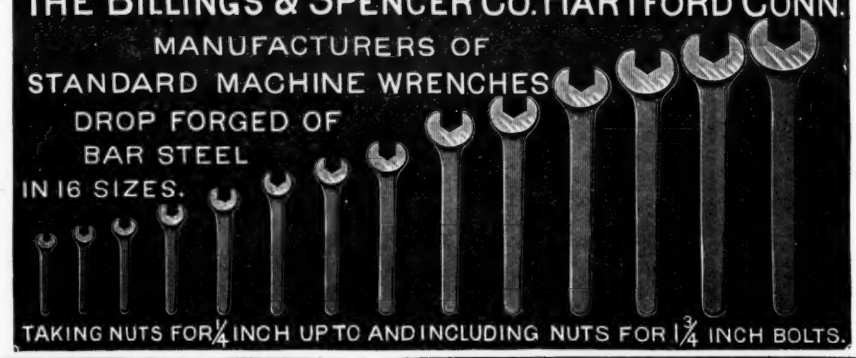
IN 16 SIZES.



TAKING NUTS FOR 1/4 INCH UP TO AND INCLUDING NUTS FOR 1 3/4 INCH BOLTS.

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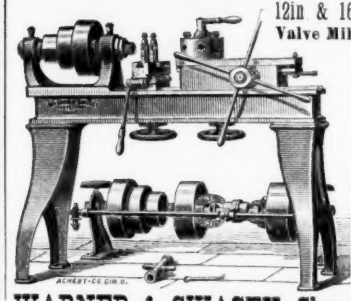

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Valve Milling Mach's
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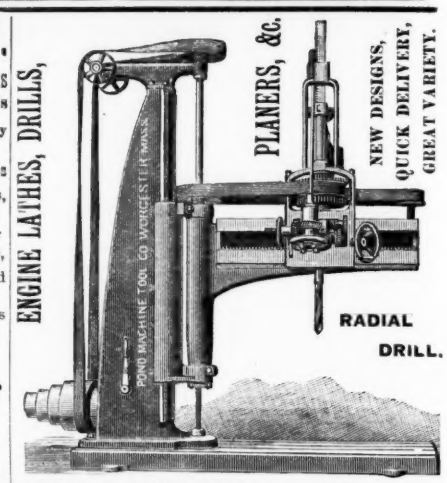

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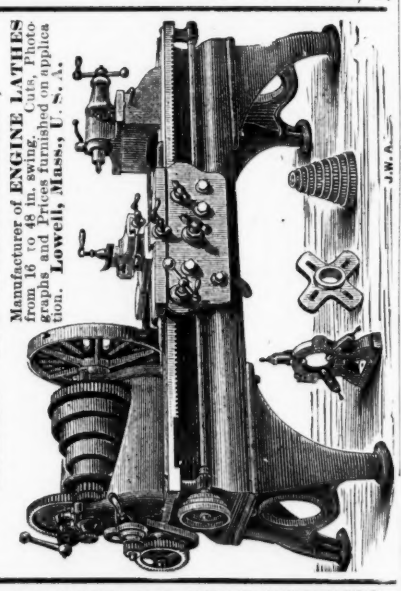

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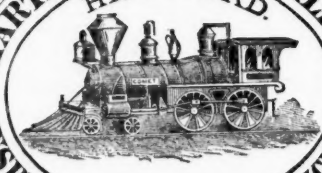

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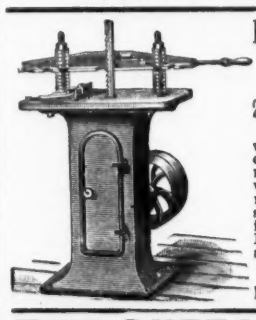

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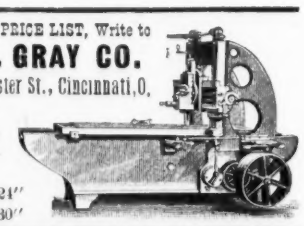

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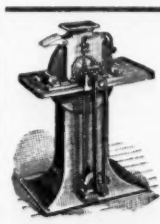

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